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p. 259

Space Exploration Initiative Candidate Nuclear Propulsion Test Facilities

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April 1993

(NASA-TM-105710) SPACE EXPLORATION
INITIATIVE CANDIDATE NUCLEAR
PROPULSION TEST FACILITIES (NASA)
259 p

N93-24753

Unclas

G3/20 0158841



SPACE EXPLORATION INITIATIVE CANDIDATE NUCLEAR

PROPULSION TEST FACILITIES

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ABSTRACT

This document provides one-page descriptions for approximately 200 existing government, university, and industry facilities which may be available in the future to support SEI nuclear propulsion technology development and test program requirements.

To facilitate use of the information, the candidate facilities are listed both by location (Index L) and by Facility Type (Index FT). The included one-page descriptions provide a brief narrative description of facility capability, suggest potential uses for each facility, and designate a point of contact for additional information that may be needed in the future.

The Nuclear Propulsion Office at NASA Lewis presently plans to maintain, expand, and update this information periodically for use by NASA, DOE, and DOD personnel involved in planning various phases of the SEI Nuclear Propulsion Project. You may send information on other facilities you would like to have added to the data base (see form page iii), or updates to the present facility descriptions, to John Clark at 216 891-2174 (Fax Ext. 2192).

Acknowledgement

The information contained in this document has been provided by members of the SEI Nuclear Propulsion Test Facility Panel and other government, university, and industry representatives who attended panel meetings and assisted in identifying and defining facility requirements. Appreciation is expressed to the following primary contributors who volunteered their time, knowledge, and writing skills to the preparation of this information.

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NUCLEAR PROPULSION FACILITY DATABASE

Facility Name : _____ Contract : _____

Address : _____

Location: _____

Telephone: _____

Data Fax : _____

Description: _____

Potential Use(s); _____

Keywords: _____

Required Modifications/Additions: _____

Status: Operational ☐ Under Construction ☐ Under Repair ☐ Standby ☐ Deactivated ☐

Year Last Operated _____ Est. Year Avail: _____ Est. Construction/Modification Cost (\$M) _____

Prepared By: _____ Date Prepared: _____ Phone: _____ FAX: _____

Candidate Nuclear Propulsion Facilities

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- Rocket Dynamics and Control Facility (B-3) Location: Lewis - Plum Brook	4
- Rocket Engine Test Facility Location: Lewis	9
- Rocket Development Test Cell (J-3) Location: Arnold (AEDC)	93
- Rocket Development Test Cell (J-6) Location: Arnold (AEDC)	94
- Hydrogen Flow Through Test Cell (C-1) Location: Arnold (AEDC)	96
- LOX/Hydrogen Rocket Engine Component Test Facility Location: Edwards (Phillips Laboratory)	117
- FI Engine Static Test Stand (EP4696) Location: Marshall	120
- LH2 Slosh Test Facility (EP4557) Location: Marshall	121
- Propulsion Components Test Facility (EP4522) Location: Marshall	122

COLD FLOW NON-NUCLEAR TESTING (CONT'D)

- Hydrogen Flow Facility (EPHFF) Location: Marshall	124
- S(1C) Stage Static Test Tower (EP4679) Location: Marshall	126
- Propulsion Component Test Facility (EP4548.1) Location: Marshall	127
- Hydrogen Propellant Test Facility (Stand 115) Location: Marshall	131
- Thermal Vacuum Chamber Facility (EP4557.4) Location: Marshall	133
- Cryogenic Test Facility (EH4628.1) Location: Marshall	142
- Propulsion Component Altitude Test Facility (EP4530.1) Location: Marshall	148
- B (1) Engine Test Stand Location: Stennis	150
- B (2) Engine Test Stand Location: Stennis	151
- Component Test Facility Location: Stennis	152
- Cryogenic Flow Facility Location: Stennis	153
- Diagnostic Testbed Facility Location: Stennis	154
- Propulsion Test Stand (401) Location: White Sands	156
- Propulsion Test Stand (402) Location: White Sands	157
- Propulsion Test Stand (405) Location: White Sands	158
- Nuclear Rocket Engine Test Facility Location: NRDS - Nevada	170
- Cold Flow Test Facility Location: Babcock and Wilcox	194

COLD FLOW NON-NUCLEAR TESTING (CONT'D)

- Rocket Engine Test Facility Location: Aerojet Propulsion	196
- Simulated Altitude Engine Test Facility Location: Aerojet Propulsion	197
- A (6) Liquid Hydrogen Facility Location: Aerojet Propulsion	198
- Rocket Engine Test Facility Location: Rocketdyne	204
- San Tan Hydrogen Test Facility Location: Garrett Fluid Systems Division	208
- Space Propulsion Test Facility Location: Pratt and Whitney	210

MECHANICAL/STRUCTURAL TESTING

- Environmental Testing Facility - Standard Machines Location: Los Alamos	19
- Environmental Testing Facility - High Capacity Machine Location: Los Alamos	20
- Centrifuge Facility Location: Sandia	65
- Component Shock Test Facility Location: Sandia	66
- Pyrotechnic Shock Simulation Facility Location: Sandia	67
- Vibration and Modal Testing Facilities Location: Sandia	68
- Horizontal Actuator - Shock Loading Location: Sandia	77
- Dynamic Structural Test Facility Location: Marshall	139
- Mated Vehicle Ground Vertical Test Facility Location: Marshall	140
- Cryogenic Test Facility Location: Marshall	142
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MECHANICAL/STRUCTURAL TESTING (CONT'D)

- Propulsion Component Altitude Test Facility Location: Marshall	148
- Component Test Facility Location: Stennis	152
- Cryogenic Flow Facility Location: Stennis	153
- Diagnostic Testbed Facility Location: Stennis	154
- Detonation Test Facilities Location: White Sands	159
- Large Scale Hydrogen/Oxygen Explosion Test Facility Location: White Sands	160
- Hazardous Hypervelocity Impact Test Facility Location: White Sands	161
- Advanced Materials Development Location: Babcock and Wilcox	193
- Cold Flow Test Facility Location: Babcock and Wilcox	194
- Dynamic Test Facility Location: Aerojet Propulsion	199
- Metallurgical Laboratory Location: Rocketdyne	1205
- Materials and Structures Laboratory Location: Pratt and Whitney	211

R & D INVESTIGATIONS

- Hydrogen Heat Transfer Facility Location: Lewis - Plum Brook	1
- Cryogenic Propellant Tank Research Facility Location: Lewis - Plum Brook	2
- Zero Gravity Facility Location: Lewis	11
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- Hypersonic Hydrogen Simulation Facility Location: Los Alamos	21
- High Temperature Kinetics Cell (TA-46) Location: Los Alamos	23
- Radio Frequency (RF) Discharge driven Supersonic Wind Tunnel Location: Los Alamos	24
- Critical Experiments Facility Location: Los Alamos	36
- Tower Shielding Facility Location: Oak Ridge	41
- Experimental Gas Cooled Reactor Location: Oak Ridge	42
- Nuclear Safety Pilot Plant Location: Oak Ridge	47
- Fission Product Release Test Facility Location: Oak Ridge	49
- Component Shock Test Facility Location: Sandia	66
- Pyrotechnic Shock Simulation Facility Location: Sandia	67
- Hyper Velocity Launch Facility Location: Sandia	71
- DOE Measurement Standards Facility Location: Sandia	75
- Aerosol Research Laboratory Location: Sandia	80
- Aerosol Exposure Facility Location: Sandia	84
- National Solar Thermal Test Facility Location: Sandia	85
- Fuel-Air Combustion Site Location: Sandia	86
- Research Vacuum Chamber Location: Arnold (AEDC)	87
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- Aerosol Laboratory Location: Argonne	104
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- Radiation Effects Facility (REF) Location: Brookhaven	111
- Alternating Gravient Synchrotron (AGS) Location: Brookhaven	113
- Booster Applications Facility (BAF) Location: Brookhaven	114
- Space Environment Facility (SPEFF) Location: Edward (Phillips Laboratory)	115
- Solar Thermal Propulsion Rocket Location: Edwards (Phillips Laboratory)	116
- Exhaust Containment Test Facility Location: Edward (Phillips Laboratory)	118
- LH ₂ Slosh Test Facility Location: Marshall	121
- Drop Tower Facility Location: Marshall	128
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- Vacuum Facility Location: Marshall	132
- Thermal Vacuum Chamber Facility Location: Marshall	133
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Location: White Sands
- Hazardous Hypervelocity Impact Test Facility 162
Location: White Sands
- Gaseous Oxygen High Flow Test Facility 164
Location: White Sands
- High Energy Entholpy Facility 166
Location: Ames
- Space Power Advanced Components Facility 172
Location: Energy Technology Engineering Center
- Plasma Irradiation Facility 174
Location: University of Florida
- Uranium Arc Facility (UAX) 176
Location: University of Florida
- Nuclear MHD Facility (NMX) 177
Location: University of Florida
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Location: University of Florida
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Location: Lewis
- Radiant Heat Facility 55
Location: Sandia
- Climatic Test Facilities 61
Location: Sandia
- Electromagnetic Environments Simulator 64
Location: Sandia
- DOE Measurement Standards Facility 75
Location: Sandia
- Radiation Effects Facility 111
Location: Brookhaven
- Cryogenic Instrumentation Laboratory 129
Location: Marshall

CONTROL SYSTEMS DEVELOPMENT (CONT'D)

- Nuclear Instrumentation Laboratory Location: Marshall	130
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- Thermal Instrumentation Development Laboratory Location: Marshall	138
- Electronic Systems Manufacturing Facility Location: Aerojet Propulsion	200

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- Aerial Cable Facility Location: Sandia	60
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- Explosive Testing Facility Location: Sandia	63
- Component Shock Test Facility Location: Sandia	66
- Pyrotechnic Shock Simulation Facility Location: Sandia	67
- Sandia Lightning Simulator Facility Location: Sandia	69
- Kauai Rocket Launch Facility Location: Sandia	76
- Severe Accident Test Facility (Remote Site 9939) Location: Sandia	78
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SAFETY TESTING (CONT'D)

- Electromagnetic Coilgun Launcher Location: Sandia	81
- Launch and Blast Effects Simulation Facility Location: Sandia	83
- Fuel Air Combustion Site Location: Sandia	86
- Detonation Test Facilities Location: White Sands	159
- Large Scale Hydrogen/Oxygen Explosion Test Facility Location: White Sands	160
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NUCLEAR ROCKET REACTOR/ENGINE TESTING

- Reactor Test Facility (Test Cell "A") Location: NRDS - Nevada	168
- Reactor Test Facility (Test Cell "C") Location: NRDS - Nevada	169
- Rocket Engine Test Facility (Test Stand No.1) Location: NRDS - Nevada	170
- Engine Maintenance, Assembly, and Disassembly Facility (E - MAD) Location: NRDS - Nevada	171

ELECTRIC PROPULSION THRUSTER TESTING

- Space Power Facility Location: Lewis - Plum Brook	5
- Electric Propulsion Laboratory (Tank 5) Location: Lewis	7
- Electric Propulsion Laboratory (Tank 6) Location: Lewis	8
- Mirror Fusion Test Facility Location: Livermore	15
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ELECTRIC PROPULSION THRUSTER TESTING (CONT'D)

- Large Coil Test Facility Location: Oak Ridge	39
- High Power Test Facility Location: Oak Ridge	45
- Medium Energy Test Facility Location: Oak Ridge	46
- 10V Chamber Location: Arnold (AEDC)	88
- 12V Chamber Location: Arnold (AEDC)	89
- Mark I Chamber Location: Arnold (AEDC)	90
- Rocket Development Test Cell (J-2A) Location: Arnold (AEDC)	92
- Multistage Steam Ejector Altitude Facilities Location: Arnold (AEDC)	95
- Electric Propulsion Laboratory (EPL) Location: Edwards (Phillips Laboratory)	119

ELECTRIC PROPULSION POWER CONVERSION TESTING

- Space Power Facility Location: Lewis - Plum Brook	5
- Thermal Hydraulic Out of Reactor Safety Facility Location: Oak Ridge	38
- 10V Vacuum Chamber Location: Arnold (AEDC)	88
- Mark I Chamber Location: Arnold (AEDC)	90
- Rocket Development Test Cell (J-2A) Location: Arnold (AEDC)	92
- Space Power Advanced Components Facility Location: Energy Technology Engineering Center	172

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- Space Power Facility 5
Location: Lewis Plum Brook
- Thorium Uranium Recycle Facility 43
Location: Oak Ridge
- SP100 Ground Test Facility 106
Location: Hanford

ELECTRIC PROPULSION INTEGRATED SYSTEM TESTING

- Space Power Facility 5
Location: Lewis - Plum Brook

Hydrogen Heat Transfer Facility (HHTF)
(Presently Hypersonic Tunnel Fctly (HTF))
NASA - Plum Brook Station
Sandusky, OH 44870

Robert P. Kozar
NASA - Plum Brook Station
Sandusky, OH 44870
Phone: (419) 621-3205 FAX: (419) 621-3236

Description:

The HHTF, presently modified for dual service as a hypersonic tunnel facility, is a blowdown type of facility which is capable of supplying inductively heated hot hydrogen gas at pressures up to 1200 psi and at temperatures up to 3000°K, or possibly up to 10000°K with the addition of a hydrogen plasma superheater. At a gas temperature of 3000°K, design flow times and rates range from 720 seconds at 2 #/sec to 22 seconds at 45#/sec. The facility can also provide altitude simulation.

Potential Use(s):

Electrically heated nuclear fuel element screening evaluations; high heat flux (900-1000 isp) nozzle development; high temperature hydrogen dissociation/recombination research; and possibly extreme heat flux (5000 isp) nozzle investigations (gas core technology) with the addition of a 15 MW plasma superheater.

Keywords: thermal propulsion, hot hydrogen, fuel screening, nozzle development

Required Modifications/Additions:

The graphite modules of the existing 3 MW induction heater will require high temperature corrosion resistant protective coatings; hydrogen supply and transfer systems require rehab and recertification; facility control and instrumentation systems require upgrading; addition of a 15 MW hydrogen plasma superheater (optional).

Status: STANDBY

Year Last Operated: 1974

Estimated Year Available: 1995

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 1/30/1991
FAX: (216) 826-6613

Cryogenic Propellant Tank Research
Facility (CPTRF) (K - Site)
NASA - Plum Brook Station
Sandusky, OH 44870

Robert P. Kozar

NASA - Plum Brook Station
Sandusky, OH 44870
Phone: (419) 621-3205 FAX: (419) 621-3206

Description:

The CPTRF is a 25 foot diameter spherical vacuum chamber designed for performance testing a wide variety of rocket vehicle propellant tank systems including liquid hydrogen and other cryogenic fuels. The facility is capable of performing fluid slosh tests, fill and expulsion tests, thermal performance of tank insulation, and performance testing of shadow shield systems. The facility is also capable of producing 800 gallon batches of slush hydrogen for experimental investigations.

Potential Use(s):

Develop and demonstrate liquid or slush hydrogen tankage and transfer systems for nuclear thermal propulsion (NTP) vehicle applications.

Keywords: liquid hydrogen fuel tanks, thermal propulsion, ion propulsion, slush hydrogen

Required Modifications/Additions:

Expand and upgrade existing liquid hydrogen storage and transfer facilities.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
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Date Prepared: 1/31/1991
FAX: (216) 826-6613

Spacecraft Propulsion Research Facility
(SPRF) (B-2 Site)
NASA - Plum Brook Station
Sandusky, OH 44870

Robert P. Kozar

NASA - Plum Brook Station
Sandusky, OH 44870
Phone: (419) 621-3205 FAX: (419) 621-3236

Description:

The SPRF was designed to conduct non-nuclear research and validation tests on a wide variety of spacecraft propulsion systems including hydrogen propelled engines. The facility provides space simulation using solar lamps and LN2 cryopanel and a high capacity vacuum pumping system. It can accomodate vehicles up to 22 ft in diameter and 50 feet high. The facility is also equipped with a 3 stage steam ejector system which can provide short duration altitude simulation for high thrust engines

Potential Use(s):

Liquid hydrogen cold flow thermal investigations, bootstrapping start-up investigations, phase flow stability studies, nozzle/deflector flow distribution analysis, hot or cold soak investigations, and possibly non-nuclear fuel element structural support verification tests

Keyword: non-nuclear hydrogen cold flow, space soak, flow distribution, bootstrapping

Required Modifications/Additions:

Test and recertification of the liquid hydrogen supply and transfer systems; rehab and reactivation of the steam ejector system; reactivation of the LN2 cryopanel and solar lamp array systems; and upgrade of the facility control and instrumentation systems.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1997

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 1/31/1991
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Rocket Dynamics and Control Facility
(B-3 Stand)
NASA - Plumbrook Station
Sandusky, OH 44870

Robert P. Kozar

NASA - Plumbrook Station
Sandusky, OH 44870
Phone: (419) 621-3205 FAX: (419) 621-3226

Description:

This facility is designed to conduct structural verification and vibration analysis tests on various components of large rocket engines at altitude conditions. A 200,000 gallon liquid hydrogen dewar is available for propellant supply and a steam ejector system is used to simulate altitude conditions when required.

Potential Use(s):

Turbopump testing, cold flow thermal investigations in a vibration environment bootstrapping start-up demonstrations; cold flow stability studies, and structural verification tests.

Keywords: Hydrogen propellant feed system testing; structural dynamic testing; cold flow stability testing

Required Modifications/Additions:

The facility was deactivated in 1973 and some systems were salvaged. The test stand needs to be refurbished, the steam ejector system replaced; the LH2 storage tank recertified; and facility local and remote control systems need to be upgraded and refurbished.

Status: DEACTIVATED

Year Last Operated: 1972

Estimated Year Available: 1997

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
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Date Prepared: 6/20/1992
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Space Power Facility (SPF)	Robert P. Kozar
NASA - Plum Brook Station Sandusky, OH 44870	NASA - Plum Brook Station Sandusky, OH 44870 Phone: (419) 621-3205 FAX: (419) 621-3236

Description:

The SPF consists of a 100 ft diameter by 122 ft high all aluminum thermal vacuum test chamber surrounded by a heavy concrete enclosure for nuclear shielding and containment. It includes facilities for the assembly and post-test disassembly of nuclear experiments and for handling of nuclear fuels and radioactive waste products. The facility is capable of testing nuclear space power and electric propulsion components and systems up to 15 MW thermal in a simulated thermal vacuum space environment.

Potential Use(s):

The SPF, with modifications and additions as noted below, can be used to test nuclear electric propulsion systems or modules including reactor, power conversion, radiator, and thruster (ion or MPD) components up to 15 MW thermal (4MWe - 1 MW thruster) in a simulated thermal vacuum space environment for extended periods depending upon the amount of installed cryopumping capacity.

Keywords: Nuclear, electric propulsion, integrated systems testing, sub-system qualification testing

Required Modifications/Additions:

Additional liquid nitrogen and helium cooled cryopanel; remote manipulator equipment for radioactive materials handling in existing shielded areas; upgrades and modifications as may be required to meet current nuclear testing requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1997

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 1/24/1991
FAX: (216) 826-6613

Plum Brook Reactor Facility (PBRF)
(Materials Research Reactor)
NASA - Plum Brook Station
Sandusky, OH 44870

Robert P. Kozar

NASA - Plum Brook Station
Sandusky, OH 44870
Phone: (419) 621-3205 FAX: (419) 621-3236

Description:

The PBRF is a 60 megawatt water cooled reactor which was operated for a 10 year period (1960-1970) to conduct research aimed at determining the effects of irradiation on candidate materials for nuclear space power and propulsion applications. The facility has extensive hot cell capability for post-test examinations and radioactive waste retention systems. Radiation testing can also be conducted at cryogenic conditions. The facility is now in a safe storage.

Potential Use(s):

Irradiation testing of candidate materials for nuclear space power and propulsion applications

Keywords: nuclear propulsion, materials research for space applications

Required Modifications/Additions:

Extensive restoration and refurbishment will be required to meet current QA/QC requirements for operating a materials research reactor

Status: LICENSED

Year Last Operated: 1970

Estimated Year Available: 1997

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 1/31/1991
FAX: (216) 826-6613

Electric Propulsion Laboratory (EPL) Tank 5 NASA Lewis Research Center Cleveland, OH 44135	Ronald R. Roskillly NASA Lewis Research Center Cleveland, OH 44135 Phone: (216) 433-2432 FAX: N/A
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Description:

The EPL laboratory consists of two large space-environment tanks and supporting facilities. Tank 5 is a 15 ft diameter by 60 ft long chamber with a pumping speed of 300,000 L/sec (air) at 10⁻⁶ torr. With additional LN₂ and LHe cryopumping panels, the pumping speeds can be increased to about 50 million L/sec. Present power supplies provide 40KW for ion thrusters and 250 KW for MPD thrusters.

Potential Use(s):

With additional cryopumping capacity and larger power supply systems, the facility can be used for development and life testing of multi-kilowatt ion and/or MPD thrusters at full scale for electric propulsion applications

Keywords: Ion Thrusters, MPD thrusters, electric propulsion components

Required Modifications/Additions:

Additional LN₂ and LHe cryopumping panels and larger power supplies would enable development and testing up to megawatt size thrusters

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 1/31/1991
FAX: (216) 826-6613

Electric Propulsion Laboratory (EPL)
Tank 6
NASA Lewis Research Center
Cleveland, OH 44135

Ronald R. Roskilly

NASA Lewis Research Center
Cleveland, OH 44135
Phone: (216) 433-2432 FAX: N/A

Description:

The EPL Laboratory consists of two large space-environment tanks and supporting facilities. Tank 6 is a 25 ft diameter by 70 ft long vacuum chamber with a pumping speed of 350,000 L/sec at 10⁻⁶ torr. Present power supplies provide 40 KW for ion thrusters and 250 KW for MPD thrusters.

Potential Use(s):

With additional cryopumping capacity and larger power supply systems, the facility can be used for development and life testing of multi-kilowatt ion and /or MPD thrusters at full scale for electric propulsion applications

Keywords: Ion thrusters, MPD thrusters, electric propulsion components

Required Modifications/Additions:

Additional LN2 and LHe cryopumping panels and larger power supplies would enable development and testing up to megawatt size thrusters

Status: UNDER REPAIR

Year Last Operated: 1980

Estimated Year Available: 1995

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 1/31/1991
FAX: (216) 826-6613

Rocket Engine Test Facility (RTEF)
Stand A, Stand B, Stand C
NASA Lewis Research Center
Cleveland, OH 44135

Ronald R. Roskilly
MS 106-3
NASA Lewis Research Center
Cleveland, OH 44135
Phone: (216) 433-2432 FAX: N/A

Description:

The RTEF consist of three test stands for development of non-nuclear chemical rocket components. Stand A can test H/O engines with chamber pressure up to 4000 psi and 50,000 lb thrust. Stand B provides altitude simulation for up to 3000 psi and 1500 lb thrust engines with 1000: 1 area ratio nozzles. Stand C is designed to test liquid hydrogen and liquid oxygen turbopumps and turbopump components up to 15,000 lb thrust (SSME Size)

Potential Use(s):

Based on project test requirements to be defined in the future.

Required Modifications/Additions:

Based on project test requirements to be defined in the future.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 1/31/1991
FAX: (216) 826-6613

Materials and Structures Laboratory(MSL) NASA Lewis Research Center Cleveland, OH 44135	Marvin H. Hirschberg MS: 49-6 NASA Lewis Research Center Cleveland, OH 44135 Phone: (216) 433-3206 FAX: (216) 433-8011
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Description:

The MSL is used to conduct tests on advanced materials such as superalloys, powdered metals, ceramics, polymers, and composites under extreme environmental conditions. Capabilities include tensile, fatigue, and creep testing at temperatures as high as 6000°F down to liquid helium temperatures and at thermal cycles simulating engine operations. Supporting facilities include a materials processing laboratory and a complete metallurgical and chemical analysis laboratory.

Potential Use(s):

Non-nuclear screening and testing of candidate materials for space nuclear power and propulsion applications.

Keywords: non-nuclear, advanced materials testing

Required Modifications/Additions:

As may be required to meet special test requirements

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 1/31/1991
FAX: (216) 826-6613

Zero Gravity Facility (ZGF)

NASA Lewis Research Center
Cleveland, OH 44135

Ronald R. Roskilly

MS 106-3
NASA Lewis Research Center
Cleveland, OH 44135
Phone: (216) 433-2432 FAX: N/A

Description:

The ZGF facility is designed to study the behavior of aerospace components, liquids, gases and combustion under zero gravity and low flow environments. The vertical steel chamber is 470 feet deep by 20 ft in diameter. The chamber is evacuated to reduce air drag on the test article. The facility can accomodate test articles up to 5 ft in diameter by 15 ft. in length weighing up to 3000 lb. High speed cameras and telemetry systems are used for data acquisition.

Potential Use(s):

Depends on project test requirements to be defined in the future.

Keywords: zero gravity testing

Required Modifications/Additions:

To be defined based on test requirements

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 1/31/1991
FAX: (216) 826-6613

Hydrogen Environment Materials
Testing Laboratory (Bldg 51)
NASA Lewis Research Center
Cleveland, OH 44135

Tom Herbel
NASA Lewis M/S 49-3
21000 Brookpark Rd
Cleveland, OH 44135
Phone: (216) 433-3246 FAX: (216) 433-8011

Description:

Presently capable of conducting hydrogen absorption tests on material samples in a hot hydrogen environment up to 2550 F at pressures of 4-5 psig. Facilities for conducting tensile, low cycle fatigue, crack growth, and fracture toughness tests at liquid hydrogen temperatures were deactivated in 1980 and would require rehab and recertification for future use.

Potential Use(s):

Materials testing in support of the SEI nuclear propulsion project.

Keyword: Hydrogen environment materials testing

Required Modifications/Additions:

Testing in a hot hydrogen environment is presently available without major modifications. Hydrogen testing at cryogenic temperature would require major renovation of existing facilities that were deactivated in 1980.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 6/03/1991
FAX: (216) 826-6613

Hot Hydrogen Test Bed (Bldg 16)

NASA - Lewis Research Center
Cleveland, OH 44135

James Sovey

NASA Lewis Research Center
SPTD-1

Cleveland, OH 44135

Phone: (216) 977-7454 FAX: (216) 977-7500

Description:

An electrodeless 30 KW microwave discharge test bed capable of flowing 1-120 SLM of 5000 - 8000°K hydrogen gas with chamber pressures from 1 - 10 atmospheres. The discharge chamber plenum is 5 cm in diameter.

Potential Use(s):

Use the microwave discharge test bed to simulate the plasma environment of a gas core nuclear rocket. Investigate plasma containment, energy transport and transfer, cavity wall interactions, and materials compatability.

Keywords: Hot hydrogen gas core nuclear rocket plasma simulation

Required Modifications/Additions:

Assemble and install an existing 30KW microwave power system, an existing 5 Tesla capacity magnetic field, and install and checkout instrumentation, control, and data acquisition systems.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 8/14/1991
FAX: (216) 826-6613

Simulation and Control Facility
NASA Lewis Research Center
Bldg 77 RM 112
Cleveland, OH 44135

Carl F. Lorenzo
Advanced Control Technology Branch
NASA Lewis Research Center
Cleveland, OH 44135
Phone: (216) 433-3733 FAX: (216) 433-8643

Description:

The Simulation and Control Facility is comprised of two AD100 real-time simulation computers & support systems to allow real-time & hardware-in-the loop simulation & testing. Present facility uses include: a simulation of a NASP ramjet engine & control systems & a simulation of the SSME used in developing health monitoring and diagnostics. Support systems include: a control system bread board for control system implementation; a VAX cluster for non-real-time simulation, control design & controller code generation; & several AI development workstations

Potential Use(s):

Nuclear thermal rocket engine and control system simulation and development.

Key Words: Engine development, engine simulations, control system development

Required Modifications/Additions:

Acquisition of nuclear thermal rocket engine actuator/sensor hardware and engine simulation development.

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1992

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Bruce Lehtinen
Phone: (216) 433-3746

Date Prepared: 6/27/1991
FAX: (216) 433-8643

Mirror Fusion Test Facility (MFTF)	Keith Thomassen, L-637
Lawrence Livermore National Laboratory	Lawrence Livermore National Lab
Livermore, CA	7000 East Ave
	Livermore, CA 94550
	Phone: (415) 422-9815 FAX: (415) 423-2395

Description:

The MFTF Facility has a 35' dia x 200' long vacuum tank; a 11kW LHe closed loop refrigerator; a 500 kW closed loop LN2 system, and 23 million L/sec pumping speed using 1000 m2 cryopanel and cryopumps. There is a dedicated 250 MVA power line to the facility and conditioned power for various uses. A separate computer control building is connected to facility controls by fibre optic links. The facility is partly underground and shielded with 2m thick concrete walls. There is a 60 ton crane running the length of the building and laydown space on each end.

Potential Use(s):

Any tests requiring vacuum and substantial radiation shielding. Capable of life testing any of the electric thruster concepts at full scale. Also being considered by SDIO for Neutral Particle Beam Space Simulation Facility (Integrated test of satellite prior to space flight). The design base pressure of the chamber is 1×10^{-6} Torr.

Required Modifications/Additions:

Must remove 22 large superconducting magnets; install remaining cryopanel now in storage on-site; reactivate cryosystems; and modify controls specifically for these operations.

Status: STANDBY

Year Last Operated: 1986

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith Thomassen
Phone: (415) 422-9815

Date Prepared: 1/28/1991
FAX: (415) 423-2395

TMX-U Facility

Lawrence Livermore National Laboratory
Livermore, CA 94550

Keith Thomassen

Lawrence Livermore National Laboratory
7000 East Ave.

Livermore, CA 94550

Phone: (415) 422-9815 FAX: (415) 423-2395

Description:

The TMX-U Facility has a 12' diameter X 70' long vacuum tank; cryopanel for pumping are available from MFTF neutral beam systems; large quantities of LN2 are available using existing plumbing and LHe can be obtained from nearby facilities. Tens of MW of electrical power, both raw and conditioned, are available. The facility is shielded with concrete walls and includes a bridge crane. Control and diagnostic rooms are associated with the facility.

Potential Use(s):

The facility could easily be adapted for thruster testing at intermediate sizes (about 1 MW) Cryopumping could be installed and the available utilities adapted to thruster requirements. Plasma diagnostics are available with control, analysis, and data archiving capabilities.

Keywords: Thruster testing, thruster plasma and materials diagnostic analysis

Required Modifications/Additions:

Remove magnets; install cryopump; install plumbing for LHe; adapt existing controls, diagnostics, and data handling capabilities for thruster development.

Status: STANDBY

Year Last Operated: 1987

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: E. B. Hooper
Phone: (415) 423-1409

Date Prepared: 3/01/1991
FAX: (415) 423-2395

SEI Fuel and Reactor Test Facility
Technical Area 46
Los Alamos National Laboratory
Los Alamos, NM 87544

Charles A. Anderson

Los Alamos National Laboratory
Los Alamos, NM 87544
Phone: (505) 667-5150 FAX: (505) 665-2137

Description:

This facility, developed as part of the U.S. nuclear rocket program, includes 4 test cells with a 40 ft. tall high-bay pressure vessel area, a 2.5 MWe dc power supply, a 500 kW power supply, a power distribution system connecting all test cells, a Hewlett Packard HP-1000 based data acquisition system, and a supporting machine shop. Complementing the test cells are 3 control rooms for control and observation of experiments. A gas trailer stanchion array and H2 handling system plumbed with a 3600 psi 2" line are part of the facility. A 5MWt cooling capacity is available

Potential Use(s):

Hot flow H2 tests of simulated fuel elements. Prototype scale hot flow tests of reactor components.

Keywords: Fuel element testing, reactor component testing, simulation experiments.

Required Modifications/Additions:

The control system for the dc power supply should be replaced with a modern control system. Some test refurbishment would be required.

Status: STANDBY

Year Last Operated: 1986

Estimated Year Available: 1992

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Charles A. Anderson
Phone: (505) 667-5150

Date Prepared: 2/15/1991
FAX: (505) 665-2137

Thermal Vacuum Test Facility Technical Area 46 Los Alamos National Laboratory Los Alamos, NM 87544	Mike Merrigan Los Alamos National Laboratory Los Alamos, NM 87544 Phone: (505) 667-5150 FAX: (505) 665-2137																																				
Description: This facility comprises vacuum chambers of various sizes (up to 8'dia x 8 8'long), RF generators (up to 125 kWe), and a cooling water system of high capacity for thermal testing of high temperature space components such as heat rejection devices. An up-to-date data acquisition system for control and monitoring of experiments and for data recovery are part of this facility. Instrumentation includes near & far IR visualization and recording systems. The facility also includes specialized equipment for fabrication of wicks for heat pipes & other specialized fabrication.																																					
Potential Use(s): Testing of heat pipes to 2000 k as well as testing of other high temperature/high heat flux heat transfer devices. Keywords: heat rejection, heat pipes, thermal management																																					
Required Modifications/Additions: Facility is operational																																					
Status: OPERATIONAL <div style="display: flex; justify-content: space-between;"> Year Last Operated: 1990 Estimated Year Available: 1991 </div>																																					
Estimated Capital Cost: <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 10%;">FY</td> <td style="width: 10%;">92</td> <td style="width: 10%;">93</td> <td style="width: 10%;">94</td> <td style="width: 10%;">95</td> <td style="width: 10%;">96</td> <td style="width: 10%;">97</td> <td style="width: 10%;">98</td> <td style="width: 10%;">99</td> </tr> <tr> <td>\$M</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 10%;">FY</td> <td style="width: 10%;">00</td> <td style="width: 10%;">01</td> <td style="width: 10%;">02</td> <td style="width: 10%;">03</td> <td style="width: 10%;">04</td> <td style="width: 10%;">05</td> <td style="width: 10%;">06</td> <td style="width: 10%;">Total</td> </tr> <tr> <td>\$M</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>		FY	92	93	94	95	96	97	98	99	\$M									FY	00	01	02	03	04	05	06	Total	\$M								
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Environmental Testing Facility-Standard
Environmental Test Machines
Los Alamos National Laboratory
Los Alamos, NM 87545

John J. Ruminer
Los Alamos National Laboratory
P O Box 1663, MS C931
Los Alamos, NM 87545
Phone: (505) 667-6317 FAX: (505) 665-5127

Description:

The Environmental Testing Facility encompasses an area that contains many buildings and a 150 ft drop tower. Housed in the buildings are standard environmental test machines such as a 50000 lb force universal testing machine; a 5.5'x7'x5.5' temperature chamber with a temperature cycling range of -70°C to +180°C; a large shaker with force capacity of 36000lbs: & a Lansmont 610 impact machine with a 2000lb load capacity and a 5000g acceleration limit. The shaker is capable of applying vibration frequencies from 5 -5000 hz on vertical, horizontal or inclined axes.

Potential Use(s):

Material compatibility tests in the temperature chamber to determine the effects of temperature on materials and structural assemblies. Shakers evaluate the effects of vibration on space payloads, weapon system components and scientific instrumentation packages. The impact machine and drop tower determine the effects of mechanical shock on structures that operate in high-acceleration environments.

Keywords: force, crush, temperature, impact, vibration, shock, acceleration

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: J. S. Cullen
Phone: (505) 667-6267

Date Prepared: 2/19/1991
FAX: (505) 843-6317

Environmental Testing Facility-High
Capacity Universal Test Machine
Los Alamos National Laboratory
Los Alamos, NM 87545

John J. Ruminer
Los Alamos National Laboratory
P. O. Box 1663 MS C931
Los Alamos, NM 87545
Phone: (505) 667-6317 FAX: (505) 665-5127

Description:

The MTS Corporation high-capacity, tension-compression servo-hydraulic universal test machine can apply up to 2 million pounds of force to a test object. It will test objects up to 1 meter in diameter by 2 meters in length.

Potential Use(s):

The high-capacity universal test machine evaluates structural capabilities of engineering designs at actual load levels and can be used for testing system components and subassemblies.

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: J. S. Cullen
Phone: (505) 665-5127

Date Prepared: 2/19/1991
FAX: (505) 855-5127

Hypersonic Hydrogen Simulation Facility
(HHSF)
Los Alamos National Laboratory
Los Alamos, NM 87545

Jon B. Cross
Los Alamos National Laboratory
CLS-2, MS G738,
Los Alamos, NM 87545
Phone: (505) 667-0511 FAX: (505) 665-4631

Description:

HHSF is designed to produce a molecular/atomic beam of hydrogen over a range of Mach numbers of 0-15 using any number of different nozzle materials. The facility has diagnostics to measure the time-of-flight distribution (velocity) of the hydrogen and a mass spectrometer to evaluate nozzle erosion products entrained in the hydrogen produced by the source conditions. Strict control and characterization of impurities in the hydrogen beam is accomplished using atomic/molecular beam techniques and diagnostics.

Potential Use(s):

The facility can be employed to evaluate space nozzle operating parameters (temperature, pressure, materials, etc.) and to determine the erosion characteristics of proposed nozzle materials, i.e. nozzle operating lifetime. The facility is capable of exposing sample materials under controlled interface states to a beam of hydrogen for subsequent measurement of hydrogen diffusion rate and materials strength characteristics.

Required Modifications/Additions:

Need nozzle or other test article or test specimen fabrication.

Status: STANDBY

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Jon B. Cross
Phone: (505) 667-0511

Date Prepared: 2/25/1991
FAX: (505) 843-0511

Low Planet Orbit Simulator (LPOS)

Los Alamos National Laboratory
Los Alamos, NM 87545

Jon B. Cross

Los Alamos National Laboratory
CLS-2 MS G738

Los Alamos, NM 87545

Phone: (505) 667-0511 FAX: (505) 665-4631

Description:

The LPOS consists of 1) a hypersonic atomic oxygen source which is capable of producing an atomic oxygen beam having a Mach number between 10-20 with an intensity 100-1000 times that found in either low Earth orbit or low Mars orbit; 2) radiation sources which produce an electron beam up to 100 kV, X-rays at 1200 eV, charged particle beams of either positive or negative charges up to 20 keV, and VUV photons; and 3) diagnostics to determine effects of the simulated space environment on materials properties. The design pressure of the system is 10^{-9} torr.

Potential Use(s):

Capable of space environment accelerated testing of spacecraft materials, sensors, or systems. The system is designed for accelerated materials certification related to NASA and SDIO programs. Twenty year life fluence of atomic oxygen can be obtained in a matter of weeks.

Required Modifications/Additions:

Need to purchase and install charged particle beam sources, i.e. electron and positive/negative ion sources.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Jon B. Cross

Phone: (505) 667-0511

Date Prepared: 2/25/1991

FAX: (505) 843-0511

High Temperature Kinetics Cell
Bldg 31 TA-46
Los Alamos National Laboratory
Los Alamos, NM 87545

Richard Oldenberg
CLS-4 MS-J567
Los Alamos National Laboratory
Los Alamos, NM 87545
Phone: (505) 667-2096 FAX: (505) 665-2840

Description:

Cell provides well controlled conditions at temperatures up to 2500k and pressures up to several atmospheres. Has good optical access.

Potential Use(s):

- (1) To study the chemistry of gas-phase and gas-surface interactions.
- (2) To develop optical diagnostics for gases or surfaces under extreme conditions.

Keywords: Kinetics, chemistry, interface, diagnostics

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Richard Oldenberg
Phone: (505) 667-2096

Date Prepared: 2/25/1991
FAX: (505) 665-2840

Radio Frequency (RF) Discharge Driven
Supersonic Wind Tunnel
Los Alamos National Laboratory
Los Alamos, NM 87545

Paul Wantuck
Los Alamos National Laboratory
MS-J565
Los Alamos, NM 87545
Phone: (505) 667-5249 FAX: (505) 665-2840

Description:

The radio frequency (RF) discharge driven wind tunnel provides high temperature (1000-10000K) high speed, chemically clean gas flows (including hydrogen) in continuous operation. An inductively-coupled plasma tube, of in-house design, is used to heat the nozzle source gas. As presently configured the system has a 0.2 MW RF power supply, a 0.5MW cooling system, a 5000 CFM CW pumping capacity (blowdown capability available) and a 3' long by 1' wide by 1' high test section with excellent optical access.

Potential Use(s):

High heat flux nozzle testing, fuel cladding survivability, hot hydrogen chemistry including surface effects, RF plasma thruster development, non-intrusive (laser-based) diagnostic development/evaluation.

Keywords: Thermal propulsion, hot hydrogen, nozzle evaluation, electric propulsion, diagnostics

Required Modifications/Additions:

Increasing system operating capability (i.e., pressure, flow rate, size. etc.) will require additional RF power.

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1992

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Paul Wantuck
Phone: (505) 667-5249

Date Prepared: 2/19/1991
FAX: (505) 843-5249

Uranium Conversion
TA-3, CMR Bldg
Los Alamos National Laboratory
Los Alamos, NM 87545

R. Bruce Matthews
Los Alamos National Laboratory
MS E505
Los Alamos, NM 87545
Phone: (505) 667-2358 FAX: (505) 665-1357

Description:

Two laboratories capable of converting up to 750 kg per year of enriched uranium to ceramic grade UO₂ feedstock in Category 1 SNM facility.

Potential Use(s):

Feedstock for fuel development and testing. Pilot plant production of NTP and NEP core feedstock.

Keywords: Fuel, Feedstock, NTP, NEP

Required Modifications/Additions:

Ventilation needs to be upgraded to comply with new ES&H requirements.

Status: STANDBY

Year Last Operated: 1989

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: R. Bruce Matthews
Phone: (505) 667-2358

Date Prepared: 2/28/1991
FAX: (505) 665-1357

Fuel Synthesis and Fabrication
TA-55
Los Alamos National Laboratory
Los Alamos, NM 87545

R. Bruce Matthews
Los Alamos National Laboratory
MS E505
Los Alamos, NM 87545
Phone: (505) 667-2358 FAX: (505) 665-1357

Description:

Category I SNM facility fuel fabrication laboratories containing 20 gloveboxes capable of fabricating up to 1000 kg of fuel/year (three compact reactor cores) in pellets. Can be converted to spherical particle or extruded fuel types.

Potential Use(s):

Synthesis and fabrication of test fuel. Pilot plant production of NTP and NEP cores.

Keywords: Fuel fabrication, spherical, particle, pellet, extruded

Required Modifications/Additions:

None for pin-type fuel. Some new equipment needed for NTP fuels.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: R. Bruce Matthews
Phone: (505) 667-2358

Date Prepared: 2/28/1991
FAX: (505) 665-1357

Fuel Component Fabrication and Assembly
TA-55
Los Alamos National Laboratory
Los Alamos, NM 87545

R. Bruce Matthews
MS E505
Los Alamos National Laboratory
Los Alamos, NM 87545
Phone: (505) 667-2358 FAX: (505) 665-1357

Description:

Category I SNM facility capable of assembling up to three compact reactor cores (about 4000 fuel pins) per year. Approximately 6 gloveboxes containing annealing, welding, assembly, and NDE Equipment

Potential Use(s):

Assembly of irradiation test pins, pilot plant production of fuel assemblies for NTP and NEP cores.

Keywords: Pin assembly, core assembly, fuel pins, test pins

Required Modifications/Additions:

None for fuel pins. Some new equipment needed for NTP fuel elements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: R. Bruce Matthews
Phone: (505) 667-2358

Date Prepared: 2/28/1991
FAX: (505) 665-1357

Fuel Characterization
TA-55
Los Alamos National Laboratory
Los Alamos, NM 87545

R. Bruce Matthews
Los Alamos National Laboratory
MS E505
Los Alamos, NM 87545
Phone: (505) 667-2358 FAX: (505) 665-1357

Description:
Approximately 10 gloveboxes containing metallographic and analytical chemistry equipment in Category I SNM facility.

Potential Use(s):
Chemical analysis and materials characterization of test fuels, NTP and NEP core fuel and material.

Keywords: QA analysis, metallography, ceramography, chemical analysis, x-ray, scanning electron microscopy of actinide compounds

Required Modifications/Additions:
To be defined based on specific project requirements.

Status: OPERATIONAL
Year Last Operated: 1990 Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: R. Bruce Matthews
Phone: (505) 667-2358

Date Prepared: 2/28/1991
FAX: (505) 665-1357

Chemical Vapor Deposition Coating
Los Alamos National Laboratory

Los Alamos, NM 87545

R. Bruce Matthews

Los Alamos National Laboratory
MS E505

Los Alamos, NM 87545

Phone: (505) 667-2358 FAX: (505) 665-1357

Description:

Coating size capability up to 20-in diam by 36-in long in Category 1 facility. Includes Location I (TA-55), Location II (TA-35, SM 213) and Location III (TA-21, SM 209)

Potential Use(s):

ZrC coatings of spherical fuel and extruded graphite rods to protect against coolant erosion and chemical interactions. Coating of fuels for irradiation testing.

Keywords: ZrC, chemical vapor deposition, coolant erosion, coated fuels.

Required Modifications/Additions:

Location I is in construction to coat uranium-containing spherical fuel and elements. Locations II and III are operational

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: R. Bruce Matthews
Phone: (505) 667-2358

Date Prepared: 2/25/1991
FAX: (505) 665-1357

Fuels Research Facility (TA-55)
Los Alamos National Laboratory

Los Alamos, NM 87545

R. Bruce Matthews

Los Alamos National Laboratory
MS E505

Los Alamos, NM 87545

Phone: (505) 667-2358 FAX: (505) 665-1357

Description:

Four gloveboxes containing five 10-kW, 0.45 MHz rf induction systems,
located in category I SNM facility.

Potential Use(s):

Characterization of high melting point fuels, development of advanced
fuels processes, analysis of irradiation performance, high temperature
compatibility testing for advanced NTP and NEP fuels.

Keywords: rf induction, high temperature, compatibility testing, melting
point, irradiation performance

Required Modifications/Additions:

Cooling systems, additional electric power, higher power 50-kW rf unit.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: R. Bruce Matthews
Phone: (505) 667-2358

Date Prepared: 2/25/1991
FAX: (505) 665-1357

Refractory Metals (TA-3)
Los Alamos National Laboratory
Sigma Bldg
Los Alamos, NM 87545

R. Bruce Matthews
Los Alamos National Laboratory
MS E505
Los Alamos, NM 87545
Phone: (505) 667-2358 FAX: (505) 665-1357

Description:

Rolling mill approximately 1 in. by 18 in. Small forge for hand-held-size pieces. Testing furnaces.

Potential Use(s):

For mechanical components/systems: Rolling, forging, swaging, extrusion, fabrication, mechanical and ballistics testing of refractory alloys and composites. Mechanical testing for fracture toughness, stress corrosion cracking, impact toughness, creep, impression creep, formability, and torsion up to 300°C. Tension testing, compression, and process simulation up to melting point of material (around 3000°C)

Keywords: Refractory materials, refractory alloys, fabrication and testing of composites:

Required Modifications/Additions:

To be defined based on specific project test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: R. Bruce Matthews
Phone: (505) 667-2358

Date Prepared: 2/25/1991
FAX: (505) 665-1357

CMR Hot Cells (TA-3)
Los Alamos National Laboratory
CMR Bldg
Los Alamos, NM 87545

R. Bruce Matthews
Los Alamos National Laboratory
MS E505
Los Alamos, NM 87545
Phone: (505) 667-2358 FAX: (505) 665-1357

Description:

16 hot cells, 6 ft x 6 ft x 11 ft, with corridor 8 ft x 31 ft x 11 ft.
It will take "alpha boxes" 65 in x 65 in by 10-1/2 ft. Category I SNM
facility for remote handling

Potential Use(s):

Postirradiation examination of reactor fuel and core materials for NEP or
NTP.

Keywords: Hot cells, postirradiation examination

Required Modifications/Additions:

To be defined based on specific project test requirements.

Status: DEACTIVATED

Year Last Operated: 1986

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: R. Bruce Matthews
Phone: (505) 667-2358

Date Prepared: 2/25/1991
FAX: (505) 665-1357

Extrusion Facility (TA-3)
Los Alamos National Laboratory
Sigma Bldg.
Los Alamos, NM 87545

R. Bruce Matthews
Los Alamos National Laboratory
MS E505
Los Alamos, NM 87545
Phone: (505) 667-2358 FAX: (505) 665-1357

Description:

Extrusions up to 2-in diam and up to 60-in long in Category III SNM facility. Can do up to 100 extrusions per week (about five reactor cores/year). Pressure capability is 150 tons, temperature of bake oven is 2400°C. Small quantities, up to 2 kg enriched uranium, can currently be processed.

Potential Use(s):

Extruded prismatic fuel forms for NEP or NTP

Keywords: Extrusion, prismatic reactor fuel

Required Modifications/Additions:

Relocation of equipment to Category I facility.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: R. Bruce Matthews
Phone: (505) 667-2358

Date Prepared: 2/25/1991
FAX: (505) 665-1357

Structural and Control Ceramics (TA-3)
Los Alamos National Laboratory
Sigma Bldg,
Los Alamos, NM 87545

R. Bruce Matthews
Los Alamos National Laboratory
MS E505
Los Alamos, NM 87545
Phone: (505) 667-2358 FAX: (505) 665-1357

Description:

Fabricate ceramic components up to 15-in diam and up to 25-in long.
Capacity up to five tons per year. Hot Isostatic presses, conventional ceramics processing, large sintering furnaces.

Potential Use(s):

High temperature insulators, lightweight support structures, control ceramics using ZrH, B₄C, SiN, SiC, MoSi₂, ZrO₂, Al₂O₃ for NTP and NEP systems. Also turbine blades for dynamic high temperature energy conversion, thermal and electric insulators, high temperature ceramic heat pipes.

Keywords: Ceramic components, high temperature insulators, structural ceramics, control ceramics, high temperature energy conversion, heat pipes.

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: R. Bruce Matthews
Phone: (505) 667-2358

Date Prepared: 2/25/1991
FAX: (505) 665-1357

Heat Source Technology Facility (TA-55)
Los Alamos National Laboratory

Los Alamos, NM 87545

R. Bruce Matthews
Los Alamos National Laboratory
MS E505
Los Alamos, NM 87545
Phone: (505) 667-2358 FAX: (505) 665-1357

Description:

Forty gloveboxes capable of processing up to 30 kg of Pu-238 oxide per year in Category I facility. Assemble up to 190, 62.5W radioisotope heat sources per year. Fuel development and processing, GTA welding, nondestructive testing, and safety testing capabilities.

Potential Use(s):

Radioisotope heat source development, fabrication, and safety testing for radioisotope thermoelectric generators.

Keywords: RTGs, radioisotope heat sources

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: R. Bruce Matthews
Phone: (505) 667-2358

Date Prepared: 2/25/1991
FAX: (505) 665-1357

Los Alamos Critical Experiments
Facility (TA-18)
Los Alamos National Laboratory
Los Alamos, NM 87544

Richard E. Malenfant
Los Alamos National Laboratory
P. O. Box 1663, MS J562
Los Alamos, NM 87544
Phone: (505) 665-5645 FAX: (505) 665-3657

Description:

A general purpose critical experiments facility comprised of three remote assembly bays each with its own control room. Each assembly bay, or Kiva, houses several general-purpose critical assembly machines. One horizontal split table can accommodate up to a 2m cube with provision for electric & pneumatic safety & controls in each half. Four vertical assembly machines operate with a combination of hydraulic, pneumatic, and electric (lead screw) major closures with provision for rotating or linear safeties & shims. Additional information is available upon request.

Potential Use(s):

Rover and Phoebus reactors were mocked up and assembled at the facility. Measurements include design mockups, control rod calibration, power density measurements, power calibration, and general code validation.

Keywords: Critical facility, reactor mockup, reactor safety, simulation experiments, control rod calibration, power density distribution measurements, reactor power measurements

Required Modifications/Additions:

The facility is operational at the present time. Three machines were recently operated at critical and two others were operated without fuel to verify control functions. A mockup of a flight reactor could probably be prepared with materials on hand.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Richard E. Malenfant
Phone: (505) 665-5645

Date Prepared: 8/05/1991
FAX: (505) 665-3657

Component Flow Test Loop
Engineering Technology Division
Bld 9201-3 Y-12 Area, Oak Ridge Natl Lab
Oak Ridge, TN 37831

Dr. John P. Sanders
Mail Stop 6392
P. O. Box 2009
Oak Ridge, TN 37831
Phone: (615) 574-0570 FAX: (615) 574-0967

Description:

The CFTL is a high-temperature, high-pressure closed loop capable of circulating chemically inactive gases at pressures to 6.2 MPa and temperatures to 1000°C. Installed gas-bearing circulators can provide a flow of 1,700 m³/h at a head of 26 KJ/kg. A controlled power supply can provide resistance heating for the gas at a maximum capacity of 5.0 MW. An installed air-cooled heat exchanger can remove 4.7 MW at the design operating temperatures. Additional information is available upon request.

Potential Use(s):

The loop can be used to perform engineering-scale performance evaluations of high-temperature or high-pressure components. This includes pumps, reaction chambers, and heat exchangers.

Keywords: High-temperature, component testing, pumps, heat exchangers

Required Modifications/Additions:

An appropriate test section must be designed and installed. The space available for this test section is a right circular cylinder approximately 3 m in diameter and 8 m in height.

Status: STANDBY

Year Last Operated: 1986

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: John P. Sanders
Phone: (615) 574-0570

Date Prepared: 2/04/1991
FAX: (615) 574-0967

Thermal Hydraulic Out of Reactor Safety
Facility (THORS)
Oak Ridge Nat'l Laboratory, Y-12 Site
Oak Ridge, TN 38931

M. H. Fontana
Mail Stop 6063, Bldg 9201-3 Y-12 Area
P. O. Box 2009
Oak Ridge, TN 37831
Phone: (615) 574-9865 FAX: (615) 576-7926

Description:

The THORS facility is a liquid metal flow loop which has been used for liquid sodium heat transfer and sodium transient boiling experiments in support of reactor safety and core design efforts. Fuel assemblies composed of up to 61 electrically heated fuel pin simulators having the same size, configuration, heat flux, and heat flux distribution as real fuel have been tested. Two MW of electrical power are controlled by SCR's so that intermediate or transient power levels can be simulated. Additional information is available upon request.

Potential Use(s):

THORS would be suitable for electrically heated tests of liquid metal systems and/or components requiring high heat fluxes and temperatures, including fuel assemblies, pumps, vapor separators, heat exchangers, lithium to potassium boilers, and space radiator segments.

Keywords: Liquid metal, heat transfer, boiling, transients, lithium, potassium, electrical testing

Required Modifications/Additions:

A vacuum or inert gas enclosure would be needed for components that require it.

Status: STANDBY

Year Last Operated: 1983

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: M. H. Fontana
Phone: (615) 574-9865

Date Prepared: 2/21/1991
FAX: (615) 574-8216

Large Coil Test Facility
Bldg 9204-1 Y-12 Area
Oak Ridge National Laboratory
Oak Ridge, TN 37831

W. L. Stirling
Oak Ridge National Laboratory
Mail Stop 8071 Bldg 9201-2 Y-12 Area
Oak Ridge, TN 37831
Phone: (615) 574-1123 FAX: (615) 576-7926

Description:

The LCTF is a large vacuum chamber about 10 M in diameter and 9 M high. The system is capable of 25 million l/s cryopumping for hydrogen at a base pressure of about 10^{-7} torr. It includes assembly and post-test disassembly capabilities for all non-nuclear tests. The facility is serviced by an overhead 55 ton crane, cooling water, LN2 and LHe, and various electrical supplies up to the MW CW range. Raw power of 16 MVA @ 13.8 kV is available. Additional information is available upon request.

Potential Use(s):

The LCTF, with the modifications noted below, can be used for electrically simulated heating for reactor core development. It is suitable for ion or MPD thruster testing or development at d.c. power levels of 1 MWe depending upon the installed cryopumping capacity. The system may also be used for electrical and mechanical components/sub-systems testing in a simulated thermal vacuum space environment.
Keywords: Ion thruster, sub-system testing, MPD, sub-system qualification

Required Modifications/Additions:

Cryopanel must be installed to meet the required pumping speeds.

Status: STANDBY

Year Last Operated: 1989

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: W. L. Stirling
Phone: (615) 483-0142

Date Prepared: 2/07/1991
FAX: (615) 576-7926

High Flux Isotope Reactor (HFIR)
Oak Ridge National Laboratory
P. O. Box 2009
Oak Ridge, TN 38931

K. R. Thomas
Oak Ridge National Laboratory
Bldg 9108 Y-12 Area Mail Stop 8087
Oak Ridge, TN 37831
Phone: (615) 574-8087 FAX: (615) 574-2102

Description:

The HFIR is a pressurized, light-water-cooled, beryllium-reflected, 85-MW research reactor with various facilities available to perform materials irradiation experiments. Recent modifications permit the operation of experiments in the flux trap region which has thermal neutron fluxes of up to 2.4×10^{19} neutrons/m²-sec and fast ($E > 0.1$ MeV) fluxes up to 1.2×10^{19} neutrons/m²-sec. Eight larger positions are now available in the removable reflector where thermal and fast fluxes of 1.4×10^{19} and 6.0×10^{18} neutrons/m²-sec are available.

Potential Use(s):

The HFIR can be used to determine the effects of neutron irradiation on components and structural materials being considered for use in nuclear propulsion systems. Candidate nuclear fuels can be irradiated to determine their performance under accelerated or actual conditions.

Keywords: Irradiation experiments, nuclear, materials testing, small components testing

Required Modifications/Additions:

As may be required to adapt to particular experiment requirements

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: K. R. Thomas
Phone: (615) 574-0255

Date Prepared: 2/13/1991
FAX: (615) 574-2102

Tower Shielding Facility (TSF)
Oak Ridge National Laboratory
P. O. Box 2009
Oak Ridge, TN 38931

Dan Ingersoll
Oak Ridge National Laboratory
Bldg 6025 X-10 Area Mail Stop 6363
Oak Ridge, TN 37831
Phone: (615) 574-6102 FAX: (615) 574-9619

Description:

The TSF is a one megawatt water cooled steady state reactor with physical arrangements for large size and deep penetration shield mockup experiments. The facility was originally used for aircraft nuclear power system shielding experiments. The shield mockups are outdoors, above ground, in a low "back-return" environment. Full instrumentation exists.

Potential Use(s):

The facility can be used for verification of basic data, analysis methods, and prototypic shield designs. It is particularly suitable for applications such as space reactors, where low environmental back scatter is desirable in tests of shielding systems.

Keywords: Nuclear electric space power systems, nuclear test, radiation, shielding, benchmark tests.

Required Modifications/Additions:

To be defined based on specific project test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Dan Ingersoll
Phone: (615) 574-6102

Date Prepared: 2/25/1991
FAX: (615) 574-9619

Experimental Gas Cooled Reactor (EGCR)
Oak Ridge National Laboratory
P. O. Box 2009
Oak Ridge, TN 38931

M. H. Fontana
Oak Ridge National Laboratory
Bldg 9201-3 Y-12 Area Mail Stop 8063
Oak Ridge, TN 37831
Phone: (615) 574-9865 FAX: (615) 574-8216

Description:

The EGCR facility contains a 50 Mwe gas cooled reactor and all associated systems including independent test loops and experimenters cell. The reactor was constructed but never operated. The containment building is 114 ft dia. by 216 ft high and has a pressure capability of 9 psia. Several free volume areas are available including a large area of 50x35x42 ft. and eight shielded cells each having dimensions of 24x31x15 ft. The 20 ft by 50 ft reactor vessel is in place. Electrical power is available at the site.

Potential Use(s):

The facility could be used for a variety of experiments and tests requiring nuclear shielding and containment. Complete space power reactor tests are feasible, especially electric power and propulsion systems. However, a direct thermal propulsion reactor (ROVER) type test would not be advisable because of the massive exhaust gas handling & cleaning requirements.

Keywords: Nuclear electric space power systems, nuclear test, radiation, shielding, containment

Required Modifications/Additions:

A vacuum or inert gas enclosure would be needed for components that require it. Possibly, the reactor vessel could be cleared out and used as a vacuum chamber.

Status: DEACTIVATED

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: M. H. Fontana
Phone: (615) 574-9865

Date Prepared: 2/21/1991
FAX: (615) 574-8216

Thorium Uranium Recycle Facility (TURF)
Oak Ridge National Laboratory
P. O. Box 2009
Oak Ridge, TN 38931

M. H. Fontana
Oak Ridge National Laboratory
Bldg 9201-3 Y-12 Area MS: 8063
Oak Ridge, TN 38931
Phone: (615) 574-9865 FAX: (615) 574-8216

Description:

The TURF is a facility originally intended for chemical processing of transuranic elements. It consists of sets of large hot cells with capability for access and transfer of large, radioactive assemblies, in a filtered-ventilated building. The facility was never used and is therefore clean and fully accessible. Several cells are available for potential tests, one of which has dimensions of 41x20x20 ft. Electrical power supply up to 7.5 Mw is available

Potential Use(s):

An extensive feasibility assessment indicated that the facility was a good candidate for testing the SP100 reactor. The facility is useful for experiments requiring large hot cell capability with shielding and filtered ventilation, such as required for nuclear electric propulsion and power systems.

Keywords: Nuclear electric space power system, nuclear tests, radiation, shielding, containment, hot cells

Required Modifications/Additions:

A vacuum or inert gas enclosure would be needed for components that require it.

Status: DEACTIVATED

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: M. H. Fontana
Phone: (615) 574-9865

Date Prepared: 2/21/1991
FAX: (615) 574-8216

High Radiation Level Examination
Facility (HRLEL)
Oak Ridge National Laboratory
Oak Ridge, TN 38931

M. H. Fontana
Oak Ridge National Laboratory
Bldg 9201-3 Y-12 Area MS 8063
Oak Ridge, TN 38931
Phone: (615) 574-9865 FAX: (615) 574-8216

Description:

The HRLEL is a facility which consists of 13 hot cells having dimensions of 6x10x14 ft. The cells are stainless steel lined, have low leak rates, and are ventilated through "absolute" filters. Fifteen ton casks can be handled. Items having dimensions of 35 cm dia and 3 m long, or 43 cm dia and 78 cm long can be introduced into the cells. All examination and analytical equipment is available for hot cell physical and chemical examinations.

Potential Use(s):

Radioactive fuel and component disassembly and examinations.

Keywords: Radiation, examination, analytical, shielding, hot cells

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: M. H. Fontana
Phone: (615) 574-9865

Date Prepared: 2/21/1991
FAX: (615) 574-8216

High Power Test Facility (HPTF)
Oak Ridge National Laboratory
Bldg 9201-2 Y-12 Area
Oak Ridge, TN 37831

W. L. Stirling
Oak Ridge National Laboratory
Bldg 9201-2 Y-12 Area Mail Stop 8071
Oak Ridge, TN 37831
Phone: (615) 574-1123 FAX: (615) 576-7926

Description:

The HPTF consists of 3 vacuum sections, each one cubic meter in size, connected by cylindrical sections of up to 1 M diameter providing an overall length of about 7 M. Each cubic section is cryopumped by approximately 5×10^{-5} l/s for H₂ having a base pressure of about 10^{-7} torr. The facility is serviced by overhead cranes, cooling water, LN₂ and LHe, and various electrical supplies up to the MW CW range.

Potential Use(s):

The HPTF is suitable for ion thruster testing or development at d. c. power levels up to 200 kW limited only by the existing pumping capacity. The facility is also well suited to MPD thruster testing the level of which is dependent upon the gas efficiency of the device

Keywords: Ion thruster, sub-system testing, MPD

Required Modifications/Additions:

To be defined based on specific project test requirements.

Status: STANDBY

Year Last Operated: 1987

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: W. L. Stirling
Phone: (615) 574-1123

Date Prepared: 2/07/1991
FAX: (615) 576-7926

Medium Energy Test Facility (METF)
Oak Ridge National Laboratory
Bldg 9201-2 Y-12 Area
Oak Ridge, TN 37831

W. L. Stirling
Oak Ridge National Laboratory
Bldg 9201-2 y-12 Area Mail Stop 8071
Oak Ridge, TN 37831
Phone: (615) 574-1123 FAX: (615) 576-7926

Description:

The METF consists of 3 vacuum sections each approximately 2x2x1 M3 connected by cylindrical sections of up to 0.5 M diameter providing an overall length of about 9 M. Each cubic section is cryopumped by approximately 5×10^{-5} l/s for H₂ having a base pressure of about 10^{-7} torr. The facility is serviced by overhead cranes, cooling water, LN₂ and LHe, and various electrical supplies up to the MW CW range.

Potential Use(s):

The METF is suitable for ion thruster testing or development at d.c. power levels up to 200 kW limited only by the existing pumping capacity. The facility is also well suited to MPD thruster testing the level of which is dependent upon the gas efficiency of the device.

Keywords: Ion thruster, sub-system testing, MPD

Required Modifications/Additions:

To be defined based on specific project test requirements.

Status: DEACTIVATED

Year Last Operated: 1985

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: W. L. Stirling
Phone: (615) 483-0142

Date Prepared: 2/07/1991
FAX: (615) 576-7926

Nuclear Safety Pilot Plant
Oak Ridge National Laboratory
P.O. Box 2009
Oak Ridge, TN 38931

T. S. Kress
Oak Ridge National Laboratory
Bldg 9108 Y-12 Area Mail Stop 8086
Oak Ridge, TN 38931
Phone: (615) 574-0561 FAX: (615) 574-2102

Description:

The Nuclear Safety Pilot Plant is a semi-remotely located facility. The major component is an insulated closed cylindrical, stainless-steel vessel (3.05 m diam.x5.49 m high x9.53 mm thick). It is equipped with steam, nitrogen gas, and electric power supplies and a plasma torch for generating high temperature plasmas from a variety of materials. It is instrumented to measure thermal hydraulics (temperatures, pressure flow patterns, humidity, and steam condensation rates) as well as the transient concentrations and size distributions of airborne particulates.

Potential Use(s):

Prior uses include transport behavior studies of gaseous fission product iodine and aerosol fission products in LWR like containments. In addition to fission product/aerosol transport studies, it could have a variety of applications including performance and durability testing of simulated propulsion components or systems.

Keywords: Nuclear, fission product behavior, fuel tests, simulation testings

Required Modifications/Additions:

Facility would need de-mothballing, reactivation, equipment requalification, data acquisition system and instrumentation up grading

Status: DEACTIVATED

Year Last Operated: 1985

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: T. S. Kress
Phone: (615) 574-0561

Date Prepared: 2/07/1991
FAX: (615) 574-2102

Hydrogen Environment Materials
Testing Laboratory
Oak Ridge National Laboratory
Oak Ridge, TN 37831

Joe Strizak
Oak Ridge National Laboratory

Oak Ridge, TN 37831
Phone: (615) 574-5117 FAX: (615) 576-8424

Description:

Capable of conducting tensile, short term creep, and low cycle fatigue tests on material samples in a hydrogen environment (precharged or insitu) at temperatures from ambient to 1600°F and at pressures up to 10,000 psi.

Potential Use(s):

Material testing in support of the SEI nuclear propulsion project.

Keywords: Hydrogen environment materials testing

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: Operational

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 8/06/1991
FAX: (216) 826-6613

Fission Product Release Test Facility
Hot Cell B, Bldg 4501
Oak Ridge National Laboratory
Oak Ridge, TN 37831

Morris F. Osborne
Mail Stop 6221
ORNL
Oak Ridge, TN 37831-6221
Phone: (615) 574-6848 FAX: (615) 574-6870

Description:

The FPRTF includes a high-temperature induction furnace and components for measurement of radioactive fission products released from irradiated reactor fuel. This hot cell-mounted facility and adjacent laboratories are designed for handling highly radioactive material. The furnace is capable of test temperatures up to 2700 K for periods of 10 to 30 min, with test atmospheres of steam, hydrogen, or inert gases. In the current furnace configuration, the isothermal test chamber is 1 in. diam x 8 in. long. Additional information is available on request.

Potential Use(s):

This facility is applicable for radioactive materials testing under high temperature and reactive atmosphere conditions. The research staff is highly experienced in this type of work, as well as with current requirements for personnel and environmental safety.

Keywords: High temperature, hydrogen, steam, reactive atmosphere

Required Modifications/Additions:

The facility is reasonably flexible; depending on the specific test requirements, the facility may be modified to provide a larger test chamber, a different configuration of collection components (deposition tubes, filters, cold traps, etc.), and/or different radiation detectors and monitoring instrumentation.

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1992

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Morris F. Osborne
Phone: (615) 574-6848

Date Prepared: 11/05/1991
FAX: (615) 574-6870

Advanced Test Reactor (ATR)

John Martinell

Idaho National Engineering Laboratory
Idaho Falls, ID 83415

INEL/EG and G Inc
Idaho Falls, ID 83415
Phone: (208) 526-8593 FAX: (208) 526-0876

Description:

The ATR is designed to study the effects of intense radiation on samples of reactor materials, especially fuels. The ATR achieves a power level of 250 MW (t) with a power density of 1 MW/L at a maximum thermal neutron flux of 10^{15} n/cm²/sec. An ATR Critical Facility (low power duplicate of the ATR) is also available within the ATR facility to test prototype experiments prior to testing of actual experiments in the ATR.

Potential Use(s):

Radiation testing of candidate materials and fuels for nuclear power or propulsion applications

Keywords: Reactor materials and fuels testing

Required Modifications/Additions:

As may be required to support specific project test requirements

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 2/01/1991
FAX: (216) 826-6613

Power Burst Facility (PBF)	John Martinell
Idaho National Engineering Laboratory Idaho Falls, ID 83415	INEL/EG and G Inc. Idaho Falls, ID 83415 Phone: (208) 526-8593 FAX: (208) 526-0876

Description:

The PBF is designed for testing fuels for commercial power reactors. It is capable of short duration high energy power bursts for simulating off design events such as loss-of-cooling accidents. Maximum power at steady state operation is 28 MW. During a burst period of 20 ms, the burst power is 270 GW with an energy release of 1350 MJ. The cylindrical reactor core is 1.3 m in diameter, 0.91 m in height, and has a central 0.21 m diameter test space

Potential Use(s):

Test of candiate reactor materials and/or fuels when exposed to off-design operating conditions.

Keywords: Reactor materials testing

Required Modifications/Additions:

As may be defined by future test requirements

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 2/04/1991
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Annular Core Research Reactor (ACRR) Sandia National Laboratories Albuquerque, NM 87185	Jim Bryson Sandia National Laboratories Division 6451 Albuquerque, NM 87185 Phone: (505)845-3210 FAX: (505)844-7154
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Description:

Annular Core Research Reactor - Study State (2MW) and Pulse (30,000 MW and FWHM 6.5 ms). - 9 in. central cavity and 20 in. external cavity (both are dry) Fuel height 20 in. -Thermal neutron column for radiography. -The reactor has a hard neutron spectrum (epi - thermal) because of its undermoderated BeO-UO₂ fuel and core configuration.

Potential Use(s):

Nuclear Thermal and Nuclear Electric Propulsion Fuels testing . -First initial screening of fuel pellets (etc.), then fuel bundles for normal and accident conditions. -Reactor I&C electronics testing (parts and systems)

Keywords: Nuclear thermal propulsion, nuclear electric propulsion, nuclear fuel testing

Required Modifications/Additions:

None initially (maybe Steady state power later)

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Frank Thome
Phone: (505)846-4987

Date Prepared: 2/01/1991
FAX: (505)846-6280

Sandia Pulse Reactor - III
(Bare Metal Fast Burst Reactor)
Sandia National Laboratories
Albuquerque, NM 87185

Jim Bryson
Sandia National Laboratories
Division 6451
Albuquerque, NM 87185
Phone: (505) 845-3210 FAX: (505) 844-7154

Description:

The SPR-III is a Fast Burst Reactor that is bare-metal and reflector controlled. It has a 17 cm diameter central cavity by about 25 cm long. Steady-state power to 10 kW (flux 5E11 NV 1 MeV Si Equiv) and pulse to about 100,000 MW and FWHM = 76 microseconds (fluence 5E14 not 1 MeV Si Equiv.). It is used primarily to meet high-neutron-fluence or pulsed high-dose requirements in the testing of electronic subsystems and components.

Potential Use(s):

Fuel testing and electronics parts testing (and in particular for survivability)

Keywords: Neutron irradiation, neutron flux, pulsed power, nuclear safety, electronic devices, reactor control, fuel testing, survivability

Required Modifications/Additions:

To be defined based on specific project test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Frank Thome
Phone: (505) 846-4987

Date Prepared: 2/01/1991
FAX: (505) 846-6280

Gamma Irradiation Facility (GIF)
Sandia National Laboratories (Area V)
Albuquerque, NM 87185

James W. Bryson
Sandia National Laboratories
Division 6451
Albuquerque, NM 87185
Phone: (505) 845-3210 FAX: (505) 844-3107

Description:

The GIF consists of two adjoining radiation cells situated over a 6-m-deep pool of demineralized water. The north cell contains a 60 cobalt source array with a strength of about 49 kilocuries and a 137 Sesium source with a strength of approximately 163 kilocuries. The south cell contains a High-Intensity Adjustable Cobalt Array (HIACA) and the steam test facility. The HIACA contains about 150 Kilocuries of 60 Cobalt and the steam facility (designed for simultaneous reactor accident tests in conjunction with the HIACA) has a working pressure of 200 psig.

Potential Use(s):

Testing of critical SEI reactor mechanisms (control drives, electronic sensors, etc.) in a large gamma flux (representative of that generated by a SEI nuclear reactor).

Keywords: Gamma flux, gamma irradiation, nuclear safety

Required Modifications/Additions:

GIF is currently available for testing

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505) 845-7024

Date Prepared: 2/01/1991
FAX: (505) 845-7763

Radiant Heat Facility

Sandia National Laboratories (Area III)
Albuquerque, NM 87185

Ned R. Keltner

Sandia National Laboratories

Div. 2737

Albuquerque, NM 87185

Phone: (505) 845-3189 FAX: (505) 845-3151

Description:

Sandia's radiant heat facility can simulate a wide range of high temperature environments and/or heat flux (from reentry heating, JP-4 or gasoline fuel fires to solar) and record the responses of the test items to these environments. Test objects up to 10 sq. m can be heated to temperatures on the order of 1800 K (smaller items can be exposed to a maximum heat flux of 4MW/sq. m up to a total electrical power of 5000 kW). Further details can be furnished upon request.

Potential Use(s):

Subject critical SEI reactor control mechanisms to reentry heat environment simulation.

Keywords: Reentry simulation, high-temperature, launch abort fires

Required Modifications/Additions:

The radiant heat facility is currently available for testing.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505) 845-7024

Date Prepared: 2/01/1991
FAX: (505) 845-7763

Hermes III (Gamma Flux Irradiator)

Sandia National Laboratories
Albuquerque, NM 87185

Richard L. Westfall
Sandia National Laboratories
Division 9343
Albuquerque, NM 87185
Phone: (505) 845-7230 FAX: N/A

Description:

Hermes III is a state-of-the-art accelerator which takes advantage of short pulse, low inductance, pulsed power technology to provide dose-rate area products which have not been previously available. Projected gamma-ray peak dose of 100 krad (Si), peak dose rate of 5E12 rads (Si)/s exposure area (50% falloff) of 500 sq.cm. and radiation pulsewidth (FHHM) of 20 ns are available. Further details can be furnished upon request.

Potential Use(s):

Testing of electronic components to determine their sensitivity to high energy gammas.

Keywords: Gamma flux, high energy gamma, safety testing, electronic components

Required Modifications/Additions:

Hermes III is currently available for testing

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505) 845-7024

Date Prepared: 2/01/1991
FAX: (505) 845-7763

Saturn (X-Ray Irradiator)

Sandia National Laboratories (Area IV)
Albuquerque, NM 87185

Richard E. Pepping
Sandia National Laboratories
Division 6465
Albuquerque, NM 87185
Phone: (505) 845-9004 FAX: (505) 845-7080

Description:

Saturn is a pulsed power driven x-ray source operated in either of two modes: 1) as a Bremsstrahlung radiation source or: 2) as a plasma radiation source. Saturn can be used for system, subsystem, component, and materials testing. A recently developed capability for clean testing of optical components in soft x-ray environments is now available to external customers. Further details can be furnished upon request.

Potential Use(s):

Testing of electronic components to determine their sensitivity to x-rays (representative of solar exposure). Bremsstrahlung radiation exposures of up to 40 krad (Si) with a dose rate of $2.2E12$ krad (Si) / sec can be achieved for an exposure area of 500 sq. cm and exposures of up to 13.5 krad (Si) with a dose rate of $4.7E11$ krad (Si) / sec can be achieved for an exposure area of 3000 sq. cm.

Keywords: X-ray, electronic components, dose, dose rate

Required Modifications/Additions:

Saturn is currently available for testing

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505) 845-7024

Date Prepared: 2/01/1991
FAX: (505) 845-7763

Water Impact Facility Sandia National Laboratories (Area III) Albuquerque, NM 87185	Douglas M. Cotter Sandia National Laboratories Division 2731 Albuquerque, NM 87185 Phone: (505) 845-3017 FAX: (505) 846-2687																																				
Description: The water impact facility is fully instrumented to allow measurements by accelerometer and high speed motion pictures. Small-scale models (ordinarily one to two inches in diameter, weighing 10 to 12 lb.) are accelerated by air-power guns to impact velocities up to 700 ft/s. Full-scale test articles (up to 3,000 lb) can be impacted into a 50 ft deep pond from a 300 ft drop tower at impact velocities up to 500 ft/s. Further details can be furnished upon request.																																					
Potential Use(s): Water impact/submersion tests for nuclear safety considerations (these tests can be performed on a full-scale mock-up of an SEI reactor). Keywords: Water immersion, nuclear safety, reactor																																					
Required Modifications/Additions: The water impact facility is currently available for testing. Any required modifications would depend on specific project test requirements.																																					
Status: OPERATIONAL <div style="display: flex; justify-content: space-between;"> Year Last Operated: 1990 Estimated Year Available: 1991 </div>																																					
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<div style="display: flex; justify-content: space-between;"> <div> Prepared by: L. C. Sanchez Phone: (505) 845-7024 </div> <div> Date Prepared: 2/01/1991 FAX: (505) 845-7763 </div> </div>																																					

Rocket Sled Facility Sandia National Laboratories (Area III) Albuquerque, NM 87185	William R. Kampfe Sandia National Laboratories Division 2735 Albuquerque, NM 87185 Phone: (505) 845-3186 FAX: (505) 845-3151
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Description:
The rocket sled facility is capable of accelerating 500 lb articles to a velocity of 6,000 ft/s (also 300,000 lb articles to 100 ft/s). Test articles can be impacted upon stationary articles or can be pneumatically ejected (for payloads up to 2500-lb) to altitudes of 250 ft. (Can perform ejection tests of 100 lb payloads to 3,100 ft/sec with an altitude of 100 ft or a recoverable sled test up to 3,000 ft/sec.) Further details can be furnished upon request.

Potential Use(s):
Investigation of severe accident phenomena (especially those occurring after launch pad take-off). Test may be performed for SEI reactor mock-up impact studies (upon non-yield targets) to verify that a nuclear critical geometry will not occur.

Keywords: Nuclear criticality, reactor, severe accident, impact

Required Modifications/Additions:
To be defined based on specific project requirements.

Status: Operational
Year Last Operated: 1990 Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez Date Prepared: 2/01/1991
Phone: (505) 845-7024 FAX: (505) 845-7763

Aerial Cable Facility
(Coyote Canyon Test Site)
Sandia National Laboratories
Albuquerque, NM 87185

Mark S. Garrett
Sandia National Laboratories
Division 2735
Albuquerque, NM 87185
Phone: (505) 844-5259 FAX: (505) 845-3151

Description:

The aerial cable facility is comprised of steel cables stretched between mountain peaks from which free-drop payloads as heavy as 3000 lb. can be dropped from heights as high as 600 ft. (yielding impact velocities up to 190 ft/sec.). Higher impact velocities (up to 1000 ft/sec.) can be achieved using a rocket pulldown technique. [Further details can be found in Development Testing Facilities/Capabilities (SAND 83-0169) and Environmental Test Facilities (SAND 83-0169 SUPP).]

Potential Use(s):

The aerial cable facility can be used for impact testing of SEI reactor mock-ups to identify reactor configuration changes (due to launch pad accidents, etc.) that are of concern with respect to nuclear safety.

Keywords: Impact, reactor mock-up, nuclear safety

Required Modifications/Additions:

The aerial cable facility is currently available for testing. Any required modifications would depend on specific project test requirements.

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1992

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505) 845-7024

Date Prepared: 2/01/1991
FAX: (505) 845-7763

Climatic Test Facilities Sandia National Laboratories Albuquerque, NM 87185	Vern Gabbard Sandia National Laboratories Division 2742 Albuquerque, NM 87185 Phone: (505) 845-8070 FAX: (505) 844-0078
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Description:

The climatic test facilities comprise a large number of test chambers located in Area I and III in Albuquerque and also in Livermore. These chambers allow the testing of items weighing up to 40,000 lb. for exposures of temperature ranging as low as -100°F to as high as 3000° F, humidity (as low as 5% to as high as 98%) and altitude range [as low as -2.5 (k ft) to as high as 250 (k ft)][Futher details can be found in Development Testing Facilities/Capabilities (SAND 83-0169) and Environmental Test Facilities (SAND 83-0169 SUPP).

Potential Use(s):

The climatic test facilities can be used for testing of critical SEI control components (such as guidance components and reactor control mechanisms) in severe environments. In addition temperature shock, salt-fog, and other special environmental effects can be provided.

Keywords: Control components, climatic, reactor control

Required Modifications/Additions:

These facilities are continuously in operation and are currently available. Any required modifications would depend on specific project test requirements.

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505) 845-7024

Date Prepared: 2/28/1991
FAX: (505) 845-7763

Lurance Canyon Burn Site

Sandia National Laboratories
Albuquerque, NM 87185

Ned Keltner/James Nakos
Sandia National Laboratories
Division 2737

Albuquerque, NM 87185
Phone: (505) 845-3189 FAX: (505) 845-3151

Description:

Major components of the fire facility are two wind shielded burners (2m round and 3m x 3m pools, an explosive-item chimney burner (specs same as above, but built for blast) and an open-pit burner (this burner is a large 30 ft x 60 ft pool for use in testing large articles such as nuclear shipping casks, trucks, etc.). Solid propellant burning in an unpressurized mode can be made to simulate launch pad accidents. Further details can be furnished upon request.

Potential Use(s):

Full-scale fire testing of SEI reactor mock-ups to determine temperature response due to severe accident (e.g., such as transportation or launch pad accidents) or operational environments.

Keywords: Severe accident, fire facility, nuclear safety, launch pad accidents

Required Modifications/Additions:

To be defined based on specific project test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505) 845-7024

Date Prepared: 2/01/1991
FAX: (505) 845-7763

Explosive Testing Facility Sandia National Laboratories Albuquerque, NM 87185	Floyd H. Mathews Sandia National Laboratories Division 2733 Albuquerque, NM 87185 Phone: (505) 845-3174 FAX: (505) 845-3151
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Description:

Explosive testing can be performed for blast testing, explosively propelled flyer plates, and surface impulse loading. Blast testing is performed with shock tubes that can direct a shock wave upon structures such as buildings or reentry vehicles (shock tubes as large as 19 ft exist). Flyer plates can be impacted upon stationary targets at velocities up to 13,800 ft/s. Surface impulse loading of critical equipment is done with the use of light sensitive explosive that is remotely spray deposited on the test article surface.

Potential Use(s):

These facilities can be used to subject reentry vehicles to impact loads and to test critical SEI safety control components (such as reactor control drive mechanism) for their response to large impulse loadings and component deformations due to severe accident scenarios.

Keywords: Severe accident, explosive, impulse loading, shock wave

Required Modifications/Additions:

Explosive facilities are currently available for use. Any required modifications would depend on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505) 845-7024

Date Prepared: 2/01/1991
FAX: (505) 845-7763

Electromagnetic Environments
Simulator (EMES)
Sandia National Laboratories
Albuquerque, NM 87185

Bill Boverie
Sandia National Laboratories
Division 2755
Albuquerque, NM 87185
Phone: (505)844-7763 FAX: (505)846-8123

Description:

The EMES test facility is used to investigate the effects of electromagnetic environments on electrical systems and components. It is capable of subjecting test articles (up to 4 m in diameter to continuous wave (CW) electric fields over the frequency range of 4 MHz to 18 GHz and electromagnetic pulse fields of 250,000 v/m. [Futher details can be found in Development Testing Facilities/Capabilities (SAND 83-0169) and Environmental Test Facilities (SAND 83-0169 SUPP).]

Potential Use(s):

The test facility can be used to simulate the effects of the Van Allen belts upon actual SEI reactor control components.

Keywords: Electric fields, electromagnetic pulse, Van Allen

Required Modifications/Additions:

This facility is in continuous use and is currently available. Any required modifications would depend on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505)845-7024

Date Prepared: 2/01/1991
FAX: (505)845-7763

Centrifuge Facility Sandia National Laboratories Albuquerque, NM 87185	Dave R. Schafer Sandia National Laboratories Division 2731 Albuquerque, NM 87185 Phone: (505) 845-3153 FAX: (505) 846-2687
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Description:

The centrifuge facilities are located in Albuquerque and at Livermore. The Albuquerque facility includes six centrifuges (2.5 and 6 ft radius), an inertial-grade, variable radius reversible machine; a spinner centrifuge; two high-onset centrifuges; a 35-ft radius outdoor centrifuge; and a 29-ft radius indoor below-grade centrifuge. A vibration shaker can be mounted on 29 ft centrifuge for combined acceleration/vibration tests. The Livermore facility is capable of spinning a 350-kg test item up to 40,000 rpms. Further details can be furnished upon request.

Potential Use(s):

The centrifuges available at SNL include the largest dynamic load capacity centrifuge in the free world. Their capacities will enable testing of both small and large components (unique to an SEI mission, such as reactor central drive mechanisms) for G-loads that would be anticipated to occur during an SEI mission. Combined acceleration / vibration testing of critical components.

Keywords: Centrifuge, reactor, nuclear safety, G-load, acceleration

Required Modifications/Additions:

Centrifuge facilities are currently available for testing. Any required modifications would depend on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505) 845-7024

Date Prepared: 2/01/1991
FAX: (505) 845-7763

Component Shock Testing Facility Sandia National Labs (Area I) Albuquerque, NM 87185	Neil T. Davie Sandia National Labs Division 2743 Albuquerque, NM 87185 Phone: (505) 844-6431 FAX: (505) 844-0078																																				
Description: This facility consists of various equipment used to produce classical pulse (e. g. haversine) shock environments. This equipment includes free-fall and accelerated drop test machines capable of testing both small and large test items. Drop machine specs: max acceleration is 20,00 Gs, max velocity change is 140 ft/sec, max component weight is 2000 lbs., minimum pulse duration is 0.3 millisec. A 5.5" ID air gun provides shock pulses up to 30,000Gs with velocity changes up to 500 ft/sec, but is limited to small components.																																					
Potential Use(s): Qualify critical components to shock loading Keywords: Shock testing, acceleration																																					
Required Modifications/Additions: To be defined based on test requirements.																																					
Status: OPERATIONAL <div style="display: flex; justify-content: space-between;"> Year Last Operated: 1991 Estimated Year Available: 1991 </div>																																					
Estimated Capital Cost: <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 10%;">FY</td> <td style="width: 10%;">92</td> <td style="width: 10%;">93</td> <td style="width: 10%;">94</td> <td style="width: 10%;">95</td> <td style="width: 10%;">96</td> <td style="width: 10%;">97</td> <td style="width: 10%;">98</td> <td style="width: 10%;">99</td> </tr> <tr> <td>\$M</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 10%;">FY</td> <td style="width: 10%;">00</td> <td style="width: 10%;">01</td> <td style="width: 10%;">02</td> <td style="width: 10%;">03</td> <td style="width: 10%;">04</td> <td style="width: 10%;">05</td> <td style="width: 10%;">06</td> <td style="width: 10%;">Total</td> </tr> <tr> <td>\$M</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>		FY	92	93	94	95	96	97	98	99	\$M									FY	00	01	02	03	04	05	06	Total	\$M								
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<div style="display: flex; justify-content: space-between;"> <div> Prepared by: Neil T. Davie Phone: (505) 844-6431 </div> <div> Date Prepared: 11/19/1991 FAX: (505) 844-0078 </div> </div>																																					

Pyrotechnic Shock Simulation Facility Sandia National Labs (Area I) Albuquerque, NM 87185	Neil T. Davie Sandia National Labs Division 2743 Albuquerque, NM 87185 Phone: (505) 844-6431 FAX: (505) 844-0078
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Description:
This facility consists of apparatus used to mechanically simulate pyrotechnic shock environments. The techniques employed provide a cost effective alternative to the use of actual ordnance devices. The mechanical simulation also provides better control and better repeatability of the shock environment. The facility is presently capable of testing components up to a 12" cube in size. The development of a capability to test much larger components is in progress.

Potential Use(s):
Qualify critical components to pyrotechnic shock environments such as stage separation shock or detonation induced shock.

Keywords: Pyrotechnic shock, Pyroshock

Required Modifications/Additions:
To be determined based on test requirements

Status: OPERATIONAL
Year Last Operated: 1991 Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Neil T. Davie Date Prepared: 11/19/1991
Phone: (505) 844-6431 FAX: (505) 844-0078

Vibration and Modal Testing Facilities
Areas I and III
Sandia National Laboratories
Albuquerque,, NM 87185

Dave O. Smallwood
Sandia National Laboratories
Division 2744
Albuquerque, NM 87185
Phone: (505) 845-3198 FAX: (505) 844-0078

Description:

The facilities are used to conduct vibration and modal tests on components, subsystems, and entire systems to determine how items respond to controlled vibrations and shocks, to define failure levels, to prove systems integrity, to determine mode of vibration, to verify theoretical models. Near zero to 3000 Hz frequencies can be supplied in various modes (i.e., sine, random, reverberant acoustic, periodic random, limiting, etc.). Additional details can be furnished upon request.

Potential Use(s):

Obtain modes of vibration of structures used for the SEI mission.
Determination of forces/strains of critical SEI components (reactor control mechanisms) due to expected vibrational inputs.

Keywords: High intensity acoustic, vibration, modal testing, induced stresses, control mechanisms, failure levels

Required Modifications/Additions:

Facilities are currently available for testing (modifications may be needed for large test articles). Acoustic facility under construction.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Lawrence C. Sanchez
Phone: (505) 845-7024

Date Prepared: 2/01/1991
FAX: (505) 845-7763

Sandia Lightning Simulator Facility
Sandia National Laboratories (Area-I)
Albuquerque, NM 87185

Larry D. Scott
Sandia National Laboratories
Division 2754
Albuquerque, NM 87185
Phone: (505) 844-8786 FAX: (505) 846-8123

Description:

The lightning simulator duplicates the characteristics of severe natural lightning currents in a controlled laboratory environment, allowing experimental verification of lightning safety on equipment ranging from components to entire systems as well as outdoor tests (for example, on fighter aircraft) the facility will produce up to two strokes per flash (peak amount of 200,000 amperes). [Further details can be found in Sandia Technology (Jan 1990) and Environmental Test Facilities (SAND 83-0169 SUPP.)]

Potential Use(s):

The lightning simulator can be used (without further modification) to test articles to determine if positive design features have been incorporated to isolate and divert lightning energy away from the critical components (especially with respect to nuclear safety)

Keywords: Lightning, integrated systems testing, sub-system qualification, nuclear safety

Required Modifications/Additions:

The lightning simulator facility is currently operational. Any required modifications would depend on specific project requirements. Up to four strokes per flash could be supported with some facility modifications.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505) 845-7024

Date Prepared: 2/01/1991
FAX: (505) 845-7763

LICA (Co-60) Irradiator
Low Intensity Cobalt Array
Sandia National Laboratories
Albuquerque, NM 87185

Frank V. Thome
Sandia National Laboratories
Division 6474
Albuquerque, NM 87185
Phone: (505) 846-4687 FAX: (505) 846-6280

Description:

A multiwire Co-60 irradiation facility that can simultaneously irradiate and heat (to 400°C) parts or materials. Dose rates from about 5 krad (Silicon)/hour to about 1 Mrad (Si)/hour. Canisters are about 5 inches ID by about 12 inch long unheated and 3 inch ID heat by about 10 in long. There is also a 24 inch ID by 2 ft long irradiator.

Potential Use(s):

Electronics parts and systems testing for reactor instrumentation and controls.

Keywords: Irradiation, electronic parts, instrumentation, controls

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: Operational

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Frank Thome
Phone: (505) 846-4987

Date Prepared: 2/01/1991
FAX: (505) 846-6280

Hyper Velocity Launch Facility

Sandia National Laboratories
Albuquerque, NM 87185

Philip L. Stanton

Sandia National Laboratories

Division 1543

Albuquerque, NM 87185

Phone: (505) 845-8439 FAX: (505) 844-0918

Description:

The Hyper Velocity Launch (HVL) Facility is a new facility. It can be used to simulate a space debris environment where test articles can be evaluated for their resistance to damage due to space debris impact. The HVL uses a two stage gun (a powder first stage and a hydrogen second stage) to impact a projectile upon a target plate. The momentum transfer from the projectile to the target plate results in a flier plate of mass up to 1 gm accelerated to velocities up to 10 km/s (modifications will increase the velocity capability up to 12 km/s in the near future).

Potential Use(s):

Determine survivability of critical reactor components, new proposed vehicle materials, new surface coatings, etc. within a space debris environment. Debris shield development.

Keywords: Space debris, survivability, space environment, debris shield, hypervelocity impact

Required Modifications/Additions:

The HVL is currently available for testing. Any required modifications would depend on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505) 845-7024

Date Prepared: 2/01/1991
FAX: (505) 845-7763

Hot Cell Facility (HCF) Sandia National Laboratories Albuquerque, NM 87185	Gilbert Cano Sandia National Laboratories Division 6454 Albuquerque, NM 87185 Phone: (505)845-3215 FAX: (505)844-7154
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Description:
The HCF is equipped a with staging area and 3 containment boxes. Each box can contain 6000 curies of F.P.(fission products), 500 curies of Pu-239 and Pu-241. Each box is 1.7 m deep x 2.4 m high; 2 boxes are 4.6 m long and one is 2.4 m long. There are two Glove Boxes for use with up to 300 curies of F. P. and five Glove Boxes for use with up to 10 millicuries of F.P.. All the boxes can be filled with inert gas. The 6000 and 500 curie limits can be increased with DOE approvals for exceptional needs.

Potential Use(s):
Propulsion fuels post-mortem investigations.

Keywords: Fuel tests, fuel inspection, post irradiation examinations, radiation shielding, hot cell, spent fuel

Required Modifications/Additions:
To be defined based on specific project requirements.

Status: OPERATIONAL
Year Last Operated: 1991 Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Frank Thome
Phone: (505)846-4987

Date Prepared: 2/01/1991
FAX: (505)846-6280

Hydrogen Environment Materials
Testing Laboratory
Sandia National Laboratory
Livermore, CA 94551-0969

Neville Moody
Sandia National Laboratory
Division 8312
Livermore, CA 94551-0969
Phone: (415) 294-2622 FAX: (415) 294-3410

Description:

Capable of conducting crack growth tests on material samples in a hydrogen environment (insitu) at ambient temperature and at pressures up to 30,000 psi; Capable of charging tensile, crack growth, and fracture toughness samples in a hydrogen environment at temperatures up to 570°F at 20,000 psi for subsequent testing.

Potential Use(s):

Material testing in support of the SEI nuclear propulsion project

Keywords: Hydrogen environment materials testing

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 8/06/1991
FAX: (216) 826-6613

X-Ray Irradiator Facility (Proto II)
Sandia National Laboratories (Area IV)
Albuquerque, NM 87185

Victor Harper-Slaboszewicz
Sandia National Laboratories
Division 9343
Albuquerque, NM 87185
Phone: (505) 845-7044 FAX: (505) 845-7820

Description:

Proto II is a radially converging accelerator with a 1.5 MeV endpoint. It was originally built as a prototype to drive inertially confined fusion targets. Subsequent modifications now allow it to operate as a nuclear-effects simulator, generating both soft x-rays for materials effects testing, and a 1.5 MeV bremsstrahlung x-rays for electronics vulnerability and survivability testing.

Potential Use(s):

Testing of electronic components and materials to determine their sensitivity to pulsed x-rays.

Key Words: x-rays, safety testing, electronic components

Required Modifications/Additions:

To be defined based on test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505) 845-7024

Date Prepared: 5/07/1991
FAX: (505) 845-7763

DOE Measurement Standards Facilities

Sandia National Laboratories
Albuquerque, NM 87185

Ralph T. Johnson
Sandia National Laboratories
Department 4340
Albuquerque, NM 87185
Phone: (505) 845-8241 FAX: (505) 844-4372

Description:

The Measurement Standards Department operates a Primary Standards Laboratory (PSL) and provides a metrology program to insure accurate measurements for the DOE nuclear weapons complex as well as for other DOE programs, government agencies, industry and universities. We develop and maintain primary standards traceable to national standards and calibrate and certify customer reference standards. A memorandum of Understanding between DOE/AL and Sandia directs us to operate a PSL and a system-wide metrology program for the nuclear weapons complex.

Potential Use(s):

Provide technical guidance, support and consultation; develop precision measurement techniques; provide oversight including technical surveys and measurements audits; and anticipate future needs.

Key Words: Precision measurement, calibrate, standards, metrology

Required Modifications/Additions:

To be defined based on test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505) 845-7025

Date Prepared: 5/07/1991
FAX: (505) 845-7763

Kauai (Rocket Launch) Test Facility

Sandia National Laboratories
Albuquerque, NM 87185

Richard G. Hay

Sandia National Laboratories

Division 2723

Albuquerque, NM 87185

Phone: (505) 845-9218 FAX: (505) 846-0078

Description:

The Kauai Test Facility (KTF) in Hawaii, residing on the Pacific Missile Range Facility, has a rocket preparation, rocket launching and data recovery capability for both rail-launched and vertical-launched rockets. Launches primarily support high-altitude scientific research and reentry vehicle systems development. Small rockets typically fly ballistic trajectories with payload attitude control systems available as an option, while the larger systems contain navigation systems. The largest system (STARS) has a total vehicle/payload weight of 36,000 lbs.

Potential Use(s):

Launch site for SEI mission (including water impact testing of SEI reactor mockups). Data acquisition for this launch site (with support from the Air Force Maui Optical Station (AMOS)) include optical, IR, metric tracking (radar) and telemetry.

Keywords: Launch site, safety testing, data recovery

Required Modifications/Additions:

To be defined based on specific project test requirements.

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505) 845-7024

Date Prepared: 5/07/1991
FAX: (505) 845-7763

Horizontal Actuator - Shock Loading Sandia National Laboratories (Area III) Albuquerque, NM 87185	Neil T. Davie Sandia National Laboratories Division 2743 Albuquerque, NM 87185 Phone: (505) 844-6431 FAX: (505) 844-0078
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Description:

This facility consists of an 18 in pneumatic actuator with a 92 ft long track. The actuator uses high pressure gases to transmit force and motion through a piston/thrust column in contact with an external load. Maximum force capability of the actuator is 700,000 lb. The test item, mounted on a sled, can be accelerated in direct contact with the thrust column or can be propelled down the track and impacted into a target. Multiple sleds can be used to obtain special pulse shapes. Maximum velocity change is 250 ft/sec.

Potential Use(s):

Determine survivability of critical reactor components, new proposed vehicle materials, etc., due to shock loading.

Keywords: shock loading, shock environments, accelerations

Required Modifications/Additions:

To be defined based on specific project test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505) 845-7024

Date Prepared: 5/07/1991
FAX: (505) 845-7764

Severe Accident Test Facility
(Remote Site 9939)
Sandia National Laboratories (Area Y)
Albuquerque, NM 87185

Ervin R. Copus
Sandia National Laboratories
Div. 6422
Albuquerque, NM 87185
Phone: (505) 845-3220 FAX: (505) 846-7412

Description:

This site incorporates two induction furnace power supplies, data acquisition capabilities, and aerosol measurement facilities. The site is currently used for the generation of large 100 to 1000 kg melts for melt-interaction studies in support of the NRC and SRL reactor safety program. The capabilities include high temperature materials compatibility studies, studies of magnetic fields for radiation and charged particle shielding, temperature behavior of reactor fuel simulants, and measurements and characterization of aerosols arising from tests.

Potential Use(s):

This site can be used to perform experiments that would be used to assess consequences of severe reactor accidents.

Keywords: Safety analysis, severe reactor accident, aerosol, melt-interactions

Required Modifications/Additions:

To be defined based on test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505) 845-7024

Date Prepared: 5/07/1991
FAX: (505) 845-7763

Severe Accident Test Facility
(Remote Site 9940)
Sandia National Laboratories (Area Y)
Albuquerque, NM 87185

David F. Beck
Sandia National Laboratories
Div. 6463
Albuquerque, NM 87185
Phone: (505) 845-7867 FAX: (505) 845-7763

Description:

This site has been primarily devoted to investigating the safety implications of mixing high-temperature molten metals or oxides with water. A 5 cubic meter chamber can be heated to 100°C and can withstand internal pressures up to 30 bars. The probability and strength of these explosive interactions can be measured, along with the gases generated and the residue debris. An external test pad is also available for studying large-scale explosions. A water tank 18 ft in diameter, 28 ft deep can be used to study underwater explosions and related phenomena.

Potential Use(s):

This site can be used to perform experiments that would be used to assess consequences of severe reactor accidents (the site has been previously used to investigate explosions up to 100 lbs TNT equivalent).

Keywords: Safety analysis, severe reactor accident, aerosol, melt-interactions

Required Modifications/Additions:

Unconfined combustion tests in excess of 100 lbs TNT equivalent would require modifications.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505) 845-7024

Date Prepared: 5/07/1991
FAX: (505) 845-7763

Aerosol Research Laboratory
(Sandia Bldg 6600)
Sandia National Laboratories (Aera III)
Albuquerque, NM 87185

John E. Brockmann
Sandia National Laboratories
Div. 6422
Albuquerque, NM 87185
Phone: (505) 845-3201 FAX: (505) 846-7412

Description:

Aerosols may be produced from the operation of pumping or compressing machinery, vibration of reactor components, or thermal or mechanical released from the fuel. These aerosols may interfere with the operation of the reactor. This facility has provided aerosol measurements and characterization support for melt-concrete interactions and pressurized melt ejection programs. The facility has calibration capabilities for aerosol and flow measuring equipment for high temperature and high concentration environments.

Potential Use(s):

A program can be generated to identify aerosol sources in the various reactor configurations under consideration and to assess their effects on the performance of the reactor would be helpful in the development of effective and reliable space nuclear reactors, both in normal operation and during accidents.

Keywords: Aerosol measurements, reactor accidents

Required Modifications/Additions:

To be defined based on test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505) 845-7024

Date Prepared: 5/07/1991
FAX: (505) 845-7763

Electromagnetic Coilgun Launcher

Sandia National Laboratories
Albuquerque, NM 87185

M. (Bill) Cowan
Sandia National Laboratories
Dept. 1220
Albuquerque, NM 87185
Phone: (505)845-7009 FAX: (505)845-7003

Description:

An electromagnetic launch technology is being developed at Sandia. The novel technology may be able to serve as an alternative to rockets for launch of small satellites from earth or liquid oxygen from the lunar surface. The technology may offer lower launch costs per payload mass. The technology uses electromagnetic induction and involves no sliding electrical contact between projectile and barrel. So far the basic principles of the launcher technology have been successfully demonstrated in a series of experimental field tests at Sandia.

Potential Use(s):

Determine survivability of critical reactor components and/or new proposed vehicle materials during high G-loads due to launch acceleration.

Keywords: Earth-to Orbit launcher, lunar mass driver survivability, high velocity impact

Required Modifications/Additions:

To be defined based on test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505)845-7024

Date Prepared: 5/07/1991
FAX: (505)845-7763

Metal Fast Burst Reactor
(Sandia Pulse Reactor - II)
Sandia National Laboratories
Albuquerque, NM 87185

Jim Bryson
Sandia National Laboratories
Div. 6451
Albuquerque, NM 87185
Phone: (505) 845-3210 FAX: (505) 844-7154

Description:

The Sandia Pulse Reactor II is a GODIVA-type, bare, fast-burst reactor capable of both pulsed and steady-state (5 kW) operation. The primary use of the reactor is for experiments mounted around the periphery. However, a central irradiation cavity (3.8-cm diameter) may also be used for small experiments. SPR II is used primarily to meet narrow-pulse, high-dose-rate requirements in the testing of electronic devices.

Potential Use(s):

Fuel testing and electronics parts testing (and in particular for survivability).

Keywords: Neutron irradiation, gamma irradiation, neutron flux, pulsed power, nuclear safety, electronic, devices, reactor control, fuel testing, survivability.

Required Modifications/Additions:

To be defined based on test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505) 845-7024

Date Prepared: 5/07/1991
FAX: (505) 844-7154

Launch and Blast Effect Simulation
Facility (Tonopah Test Range)

Tonopah, NV 89049

Ronald D. Bentley

Dept 2710

P. O. Box 871

Tonopah, NV 89049

Phone: (702) 295-8211 FAX: (702) 295-8282

Description:

The Tonopah Test Range (TTR) is an outdoor testing laboratory with capabilities for gathering data from a variety of test vehicles. The 525 square mile test area is located about 32 miles southeast of Tonopah, Nevada. The TTR is used for flight and trajectory studies, rocket static tests, and high-altitude rocket and reentry body studies. In addition to airborne vehicular tests, various areas of the range have been used for explosives studies involving blast effects, case ruptures, and shock wave phenomena that simulate objects impinging upon nuclear reactor containment walls.

Potential Use(s):

This site can be used to perform experiments that would be used to assess consequences of severe reactor accidents. For example, impact testing of SEI reactor mock-ups to identify reactor configurations changes (due to launch pad accidents, etc.) that are of concern with respect to nuclear safety.

Keywords: Safety analysis, severe reactor accident, reactor mock-up, nuclear safety

Required Modifications/Additions:

To be defined based on test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505) 845-7024

Date Prepared: 5/07/1991
FAX: (505) 845-7763

Aerosol Exposure Facility
(SURTSEY)
Sandia National Laboratories (Area III)
Albuquerque, NM 87185

Michael D. Allen
Sandia National Laboratories
Div 6422
Albuquerque, NM 87185
Phone: (505) 845-3100 FAX: (505) 846-7412

Description:

The SURTSEY facility has a 103 cubic meter chamber with a controlled atmosphere (pressures up to 10 atms) and temperatures (from ambient to 267°C) environment. It is instrumented for pressure, gas composition, temperature and aerosols. Data acquisition capabilities of 200 channels are available.

Potential Use(s):

Can be used for environmental exposure of devices or monitoring aerosol production.

Keywords: Environmental chamber, aerosol exposure, aerosol monitoring

Required Modifications/Additions:

To be defined based on test requirements.

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1994

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505) 845-7024

Date Prepared: 5/07/1991
FAX: (505) 845-7763

National Solar Thermal Test Facility Sandia National Laboratories Albuquerque, NM 87185	Christopher P. Cameron Sandia National Laboratories Div. 6215 Albuquerque, NM 87185 Phone: (505) 844-2280 FAX: (505) 844-7837
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Description:

The 5-MW National Solar Thermal Test Facility (NSTTF) employs a field of 220 individually guided heliostats to redirect sunlight onto a target up to several feet in diameter with a maximum flux of 300 w/sq. cm. Smaller test specimens may be exposed to fluxes up to 1500 w/sq. cm using one of the NSTTF's 11-m diameter parabolic dishes or one of two solar furnaces. The NSTTF also conducts research in Stirling engines and alkali-metal heat pipes.

Potential Use(s):

Although developed in support of advanced solar power technology, the high-heat-flux capability of the NSTTF is also used in areas of interest to SEI developers, such as evaluation of high-temperature materials, simulation of aerodynamic heating on radomes and antenna systems and testing of thermal and photovoltaic power conversion systems.

Keywords: Reentry simulation, high-temperature, high heat fluxes

Required Modifications/Additions:

To be defined based on test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505) 845-7024

Date Prepared: 5/07/1991
FAX: (505) 845-7763

Fuel-Air Combustion Site
(Sandia Site 9920)
Sandia National Laboratories (Area Y)
Albuquerque, NM 87185

David F. Beck
Sandia National Laboratories
Div. 6463
Albuquerque, NM 87185
Phone: (505) 845-7867 FAX: (505) 845-7763

Description:

Facilities include several combustion chambers of about 5 cubic meters in volume, the world's largest heated detonation tube (to ~ 110°C) 13.1 m long and 43 cm in diameter, a reinforced concrete channel 2.4 m x 1.8 m x 30.5 m long (used for flame acceleration and deflagration-to-detonation transition studies as functions of gas composition, degree of venting, and obstacle configuration), and apparatus for studying hot hydrogen flame jets (from 1200 K to 2000 K). Unconfined combustion tests have been performed up to 100 lbs TNT equivalent.

Potential Use(s):

Gaseous hydrogen combustion studies can be performed in support of nuclear reactor safety programs. Experiments have previously been conducted for a variety of LWR and HWR reactor safety programs, for resolving some Space Shuttle launch safety questions, and for fuel-air explosion weapons development and testing.

Keywords: Hydrogen combustion, safety tests, hot hydrogen flame jets

Required Modifications/Additions:

Unconfined combustion tests in excess of 100 lbs TNT equivalent would require modifications.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Sanchez
Phone: (505) 845-7024

Date Prepared: 5/07/1991
FAX: (505) 845-7763

Research Vacuum Chamber (RVC) (4 FT X 10 FT Chamber) Arnold AFB, TN 37389	A. B. Bailey Calspan Corp./AEDC Operations Arnold AFB, TN 37389 Phone: (615) 454-7368 FAX: (615) 454-6348																																				
Description: The RVC is a stainless steel cylindrical vacuum chamber with an internal diameter and overall length of approximately 3.5 ft. X 14 ft., respectively. The RVC is comprised of three sections: movable, stationary, and instrumentation spool piece, which are 4, 8.5, and 1.5 ft. in length, respectively. The chamber is lined with LN2 cooled cryopanel. Vacuum conditions are achieved through the use of mechanical pumps, turbomolecular pumps, and LN2 cryopumps.																																					
Potential Use(s): Small scale thruster plume contamination studies.																																					
Required Modifications/Additions: As required to meet user test requirements.																																					
Status: OPERATIONAL <div style="display: flex; justify-content: space-between;"> Year Last Operated: 1991 Estimated Year Available: 1991 </div>																																					
Estimated Capital Cost: <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 10%;">FY</td> <td style="width: 10%;">92</td> <td style="width: 10%;">93</td> <td style="width: 10%;">94</td> <td style="width: 10%;">95</td> <td style="width: 10%;">96</td> <td style="width: 10%;">97</td> <td style="width: 10%;">98</td> <td style="width: 10%;">99</td> </tr> <tr> <td>\$M</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 10%;">FY</td> <td style="width: 10%;">00</td> <td style="width: 10%;">01</td> <td style="width: 10%;">02</td> <td style="width: 10%;">03</td> <td style="width: 10%;">04</td> <td style="width: 10%;">05</td> <td style="width: 10%;">06</td> <td style="width: 10%;">Total</td> </tr> <tr> <td>\$M</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>		FY	92	93	94	95	96	97	98	99	\$M									FY	00	01	02	03	04	05	06	Total	\$M								
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<div style="display: flex; justify-content: space-between;"> <div> Prepared by: A. B. Bailey Phone: (615) 454-7368 </div> <div> Date Prepared: 2/01/1991 FAX: (615) 454-6348 </div> </div>																																					

10 V Chamber Arnold AFB, TN 37389	R. P. Hatheway MS-640 Calspan Corp/AEDC Operations Arnold AFB, TN 37389 Phone: (615) 454-7717 FAX: (615) 454-6348																																				
Description: The 10V Chamber consists of a 10 ft. diameter by 20 ft. long all stainless steel vacuum test chamber. It is equipped with an internal cryogenic system designed for high efficiency vacuum pumping of aerodynamic streams and rocket exhaust products. Mass flow rates of nitrogen up to 40 GM/sec can be tested for a few minutes utilizing the cryogenic system consisting of a 77K liquid nitrogen cooled high capture liner, 20K gaseous helium cooled surface, and 4.2K liquid helium cooled surface.																																					
Potential Use(s): The 10V chamber, with modifications and additions listed below, can be used to test sub-scale propulsion systems including power conversion, radiation, and thruster components. Keywords: Sub-scale, electric propulsion, sub-system qualifications, flow characteristics																																					
Required Modifications/Additions: Additional liquid nitrogen and helium cooled cryopanel and modifications to pumping and exhaust systems.																																					
Status: STANDBY <div style="display: flex; justify-content: space-between;"> Year Last Operated: 1981 Estimated Year Available: 1995 </div>																																					
Estimated Capital Cost: <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 10%;">FY</td> <td style="width: 10%;">92</td> <td style="width: 10%;">93</td> <td style="width: 10%;">94</td> <td style="width: 10%;">95</td> <td style="width: 10%;">96</td> <td style="width: 10%;">97</td> <td style="width: 10%;">98</td> <td style="width: 10%;">99</td> </tr> <tr> <td>\$M</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 10%;">FY</td> <td style="width: 10%;">00</td> <td style="width: 10%;">01</td> <td style="width: 10%;">02</td> <td style="width: 10%;">03</td> <td style="width: 10%;">04</td> <td style="width: 10%;">05</td> <td style="width: 10%;">06</td> <td style="width: 10%;">Total</td> </tr> <tr> <td>\$M</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>		FY	92	93	94	95	96	97	98	99	\$M									FY	00	01	02	03	04	05	06	Total	\$M								
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<div style="display: flex; justify-content: space-between;"> <div> Prepared by: R. P. Hatheway Phone: (615) 454-7717 </div> <div> Date Prepared: 1/31/1991 FAX: (615) 454-6348 </div> </div>																																					

12V Chamber Arnold AFB, TN 37389	R. P. Hatheway MS-640, Calspan Corp/AEDC Operations Arnold AFB, TN 37389 Phone: (615) 454-7717 FAX: (615) 454-6348																																				
Description: The 12V Chamber consists of a 12 ft. diameter by 35 ft. high all stainless steel thermal vacuum test chamber. The test volume is enclosed by a 10 ft. diameter liquid nitrogen cooled liner. The facility is capable of providing a well collimated and uniform beam over an 8 ft. diameter up to 1.3 solar constants with a uniformity of +5 percent.																																					
Potential Use(s): The 12V Chamber, with modifications and additions listed below, can be used for sub-scale propulsion systems, sub-system qualifications, and power conversion systems in a simulated thermal vacuum space environment. Keywords: Solar simulation, sub-scale, sub-system qualifications, integrated system testing.																																					
Required Modifications/Additions: Additional liquid nitrogen and helium cooled cryopanel and modifications to pumping and exhaust systems.																																					
Status: OPERATIONAL Year Last Operated: 1990 Estimated Year Available: 1995																																					
Estimated Capital Cost: <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 10%;">FY</td> <td style="width: 10%;">92</td> <td style="width: 10%;">93</td> <td style="width: 10%;">94</td> <td style="width: 10%;">95</td> <td style="width: 10%;">96</td> <td style="width: 10%;">97</td> <td style="width: 10%;">98</td> <td style="width: 10%;">99</td> </tr> <tr> <td>\$M</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 10%;">FY</td> <td style="width: 10%;">00</td> <td style="width: 10%;">01</td> <td style="width: 10%;">02</td> <td style="width: 10%;">03</td> <td style="width: 10%;">04</td> <td style="width: 10%;">05</td> <td style="width: 10%;">06</td> <td style="width: 10%;">Total</td> </tr> <tr> <td>\$M</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>		FY	92	93	94	95	96	97	98	99	\$M									FY	00	01	02	03	04	05	06	Total	\$M								
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\$M																																					
Prepared by: R. P. Hatheway Date Prepared: 1/31/1991 Phone: (615) 454-7717 FAX: (615) 454-6348																																					

Mark I Chamber

Arnold AFB, TN 37389

R. P. Hatheway
MS-640, Calspan Corp/AEDC Operations

Arnold AFB, TN 37389
Phone: (615) 454-7717 FAX: (615) 454-6348

Description:

The Mark I Chamber consists of a 42 ft. diameter by 80 ft. high all stainless steel thermal vacuum chamber. It includes facilities for assembly and post test disassembly of test equipment and test articles. The facility is capable of testing propulsion systems, zero "G" tests, OFVR testing, and up to .75 MW thermal in a simulated thermal space environment.

Potential Use(s):

The MarkI Chamber, with modifications and additions as noted below, can be used to test electric propulsion systems or modules including power conversion, radiation and thruster (Ion or MPD) components up to 10 MW in a simulated thermal space environment for extended periods depending upon the amount of cryopumping capacity.

Keywords: Electric propulsion, integrated systems testing, sub-system testing.

Required Modifications/Additions:

Additional liquid nitrogen and helium cooled cryopanel, upgrades, and modifications as may be required to meet the power/thermal requirements and vacuum pumping requirements.

Status: Operational

Year Last Operated: 1990

Estimated Year Available: 1997

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: R. P. Hatheway
Phone: (615) 454-7717

Date Prepared: 1/31/1991
FAX: (615) 454-6348

Materials Characterization/Contamination AEDC Arnold AFB, TN 37389	B. E. Wood Calspan Corp./AEDC Operations Arnold AFB, TN 37389 Phone: (615) 454-7719 FAX: (615) 454-6348
--	--

Description:

AEDC has a comprehensive space related contamination capability including areas of spacecraft materials outgassing characterization: the effects of contamination on optical and thermal control surfaces - including BRDF, reflectance, and absorptance: pre-flight calibration of contamination measuring devices; and contamination diagnostics.

Potential Use(s):

Materials characterization/selection: BRDF measurements; contamination effects, control, and removal; solar absorptance and reflectance measurements; contamination diagnostics.

Keywords: Materials characterization: BRDF: contamination effects, characterization, and removal; optical contamination.

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: B. E. Wood
Phone: (615) 454-7719

Date Prepared: 2/01/1991
FAX: (615) 454-6348

Rocket Development Test Cell (J-2A)
Arnold Engineering Dev Center (AEDC)

Arnold AFB, TN 37389

F. E. Turner Jr.
AEDC

Arnold AFB, TN 37389
Phone: (615) 454-7625 FAX: (615) 454-7205

Description:

Test Cell J-2A consists of an 18 ft. diam by 32 ft long vacuum chamber. With cryogenic cooling of the chamber walls, including helium refrigeration, a vacuum level of 10⁻⁵ torr can be maintained for cold soak periods up to 30 days. Radiation lamps may be used to provide partial solar simulation (up to 450 Btu/hr/sq ft). Additional cryopanel could be installed to increase the pumping speed.

Potential Use(s):

Development tests of electric space propulsion engines at ambient pressures of 10⁻⁵ torr.

Keywords: Electric propulsion, integrated systems testing, sub-system testing

Required Modifications/Additions:

Constricted arc or RF induction arc heater development is required to heat the driving gases to the required temperature levels.

Status: DEACTIVATED

Year Last Operated: 1972

Estimated Year Available: 1997

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: J. A. Reed/T. J. Gillard
Phone: (615) 454-6882

Date Prepared: 2/04/1991
FAX: (000) 000-0000

Rocket Development Test Cell (J-3)
 Engine Test Facility (ETF)
 Arnold Engineering Development Ctr (AEDC)
 Arnold AFB, TN 37389

F. E. Turner, Jr.
 Engine Test Facility, APD/EC3
 MS-500
 Arnold AFB, TN 37389
 Phone: (615) 454-7625 FAX: (615) 454-7205

Description:

Vertical rocket test cell for testing engines with up to 100,000 lb f thrust at simulated altitudes up to 125,000 ft. Test cell is 18 ft in diameter by 40 ft in height. Test cell working level is 60 ft above grade level. Supersonic engine-driven diffuser is vertical. Steam-driven ejector is horizontal and exhausts into 10-ft-diam duct connected to the ETF rotating plant through 6 stages of electrically-driven exhausters. Equipped with over 5,000 gal each storable oxidizer and fuel tanks. Has high pressure GH2 and GHe storage. Temp conditioned between +35 & +140 F.

Potential Use(s):

Development (subscale or full-scale) of thermal nuclear rocket hot section and nozzle components by using heated hydrogen. For solid-propellant and liquid-propellant rocket testing (up to 100,000 lb f thrust). Mission simulations with pressures less than 0.5 indefinite duration.

Keywords: High-altitude, high-area-ratio rocket engine testing; hot gas simulation of Thermal Nuclear Rocket (TNR) cycle.

Required Modifications/Additions:

Requires liquid hydrogen storage and run system addition. Requires hydrogen heater to simulate TNR

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1993

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: F. E. Turner, Jr.
 Phone: (615) 454-7625

Date Prepared: 2/04/1991
 FAX: (615) 454-7205

Rocket Development Test Cell (J6)
Arnold Engineering Develop CTR (AEDC)
Aronld AFB, TN 37389

F. E. Turner Jr.
AEDC, ETF/APD/EC3 MS-500
Arnold AFB, TN 37389
Phone: (615) 454-7625 FAX: (615) 454-7205

Description:

Test Cell J-6 is a large rocket test cell which is remotely located for testing high hazard motors. It is designed for testing rocket motors with up to 600,000 lbf thrust. The test cell is 26 ft. in diameter and 62 ft. in length. J6 has a large vacuum chamber between the J-6 steam ejector and the ETF rotating plant. The chamber is 245 ft in diameter by 100 ft in height (with a volume of 4.5×10^6 cubic feet).

Potential Use(s):

Because of its large size and large volume which can be pumped to an initial pressure of 0.1 psia, J6 is ideal for testing full scale thermal nuclear rocket hot section and nozzle components using heated hydrogen.

Keywords: Nuclear thermal, full scale component development

Required Modifications/Additions:

Addition of hydrogen storage and the addition of large hydrogen heater.

Status: STANDBY

Year Last Operated: 1990

Estimated Year Available: 1995

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: F. E. Turner Jr
Phone: (615) 454-7625

Date Prepared: 2/04/1991
FAX: (615) 454-7205

Multistage Steam Ejector Altitude
Facilities R2H and T4E
Arnold Engineering Development Ctr AEDC
Arnold AFB, TN 37389

F. E. Turner Jr
Engine Test Facility, AFB APD/EC3
MS-500
Arnold AFB, TN 37389
Phone: (615) 454-7625 FAX: (615) 454-7205

Description:

R2H--An operational 6-stage steam ejector high-altitude facility used for tests of small reaction control chemical propulsion devices, electric arc jets, and chemical lasers. Capabilities: altitudes to 100 km; chemical rockets to 40 N thrust; extensive diagnostics. T4E--An existing 5-stage steam ejector system not currently in operation. Probably capable of altitudes to 100 km; thrusts to 80 N.

Potential Use(s):

Development and qualification of arcjet, Resistojet, and MPD-type space thruster likely to be powered by nuclear-generated power.

Keywords: Electric propulsion, space propulsion, testing

Required Modifications/Additions:

(1) R2H: Extension of instrumentation and control capability (FY92) (2) T4E: Relocation of steam ejector and design and construction of test chamber (FY93-94) (3) Expansion of these capabilities into a system qualification test facility (FY94-95)

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1994

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: W. K. McGregor
Phone: (615) 454-7420

Date Prepared: 2/04/1991
FAX: (000) 000-0000

Hydrogen Flow Through Test Cell (C-1)
Arnold Engineering Development Ctr AEDC
Arnold AFB, TN 37389

F. E. Turner Jr.
Engine Test Facility, APD/EC3
MS-500 Arnold Air Force Base
, TN 37389
Phone: (615) 454-7625 FAX: (615) 454-7205

Description:

The C-1 test cell in the Aeropropulsion Systems Test Facility (ASTF) is 28 ft in diameter and 85 ft long. It has the capability for direct-connect and freejet testing. It has a venturi airflow-measuring system and the capability of measuring 2,000 instrumentation channels. The facility can supply airflows of approximately 2,750 lbs. with inlet temperatures ranging from -100 to 1,020°F depending on the airflow. Development of an exhaust gas hydrogen disposal system for use with airbreathing hydrogen engines is currently in progress.

Potential Use(s):

The ASTF facility, with the changes noted below, can be used to test nuclear thermal propulsion subsystems or components. The facility offers the capability of performing full-scale or subscale system/component development testing. Operability studies, and durability studies (thermal cycling).

Keywords: Full-scale component development

Required Modifications/Additions:

Installation of 15 MW H₂ heater and associated hardware; possible modification of the exhaust gas hydrogen disposal system to meet specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1997

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: J. T. Hayes
Phone: (615) 454-6313

Date Prepared: 2/01/1991
FAX: (615) 454-7205

High Entholpy Ablation Test Facility (AEDC) Arnold AFB, TN 37389	Lt Tim Lawrence OLAC PL/LSVF Building 8350 Edwards AFB, CA 93523 Phone: (805)275-5640 FAX: (805)275-5144
--	--

Description:
AEDC's High Entholpy Ablation Test facilities were developed for ablation tests on ballistic missile reentry vehicles. The H-1 (segmented arc) and H-2 (Huels arc) are capable of operating at 40-60 MW output for several minutes. Although these heaters have run on air and nitrogen, the Phillip's Lab has funded AEDC to explore using these facilities for hot hydrogen.

Potential Use(s):
Hot Hydrogen for fuel elements, nozzles, TPA can provide about 30 MW to the gas.

Required Modifications/Additions:
Modifications are required: Heater cover, H2 system, pulse system, piping mods, exhaust stack, etc. Estimated cost to do the modifications is around \$500 -1000K.

Status: OPERATIONAL
Year Last Operated: 1990 Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Tim Lawrence
Phone: (805)275-5640

Date Prepared: 2/06/1991
FAX: (805)275-5144

Experimental Breeder Reactor II (EBR-II)

Argonne National Laboratory - West
Idaho Falls, ID 83403

John Sackett

Argonne National Laboratory

P. O. Box 2528

Idaho Falls, ID 83403

Phone: (208) 533-7671 FAX: N/A

Description:

The EBR-II reactor is a liquid sodium cooled fast spectrum reactor that is currently being used as the centerpiece of the integral Fast Reactor System demonstration. It features a pool type core with inherent safety features. The reactor system produces 62.5 MW(t) of power and the turbogenerator develops 20 MWe for the local power grid. The active core length is 35cm. Individual experiments can be positioned in standard fuel locations and there are several positions for instrumented tests.

Potential Use(s):

The EBR II Facility is one of the few places in the world where irradiation testing of fuels, materials and components of nuclear propulsion systems can be undertaken in a fast reaction spectrum. Long term steady state indications (burnup, life term etc) and off normal transient irradiations are possible.

Keywords: Fast neutron irradiations, fuels/materials/components testing, reactor operations

Required Modifications/Additions:

Fabrication of special purpose irradiation assemblies as needed (e.g. large diameter test assembly, special instrumented assemblies etc).

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: S. K. Bhattacharvva
Phone: (708) 972-3293

Date Prepared: 2/04/1991
FAX: (708) 972-4007

Alpha/Gamma Hot Cell Facility (AGHCF)	L. A. Neimark
Argonne National Laboratory Argonne,, IL 60439	Argonne National Laboratory Argonne, IL 60439 Phone: (708)972-5177 FAX: (708)972-4798

Description:

The AGHCF is a high-purity N₂, kilocurie hot-cell and an associated electron beam laboratory. Principal activities carried out in the facility are (1) the disassembly and examination of irradiation experiments, (2) the microstructural and microchemical characterization of irradiated materials, and (3) the conduct of specified experiments on irradiated materials and components. Assemblies are limited to 6 ft. in length and 6 in diameter.

Potential Use(s):

The AGHCF, together with a smaller companion hot-cell facility, can be used for the performance evaluation of fuel components and non-fueled structural components. Specialized heating equipment can be used to test material at conditions not possible in a reactor.

Keywords: Nuclear, fuel, hot-cell, materials evaluation

Required Modifications/Additions:

Upgrades of older cell systems, e. g., electro-mechanical manipulators, window refurbishment, replacement of an older scanning electron microscope

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1994

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. A. Neimark
Phone: (708)972-5177

Date Prepared: 2/01/1991
FAX: (708)972-4798

Transient Reactor (TREAT)
ANL-W
Idaho National Engineering Laboratory
Idaho Falls, ID 83403

L. J. Harrison
Argonne National Laboratory-West
P.O. Box 2528
Idaho Falls, ID 83403
Phone: (208) 533-7242 FAX: (208) 533-7172

Description:

TREAT is a research reactor designed to provide neutrons and gamma radiation at relatively high values for very short periods of time (10s of seconds to a few minutes). The reactor operates in a transient or pulsed mode. An on-line closed-loop computer control system can generate a wide variety of pulse shapes. Relatively large volume experiments (typical maximum 4 in. x 8 in. x 12 ft) can be accommodated in the air environment.

Potential Use(s):

Irradiate fuels and materials in a pulsed mode to simulate high power and/or accident conditions. Virtually any fuel, material or coolant can be irradiated. Each experiment must be contained in a sealed package for irradiation.

Keywords: Reactor, nuclear fuel, transient or pulsed testing, reactor accident simulation

Required Modifications/Additions:

Self-contained experiment packages must be provided with required environment conditioning equipment (e.g. heaters, coolant, vacuum, pressurizers, etc)

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. J/ Harrison
Phone: (208) 533-7242

Date Prepared: 1/31/1991
FAX: (208) 533-7172

Hot Fuel Examination Facility (HFEF)

Argonne National Laboratory-West
Idaho Falls, ID 83403

John P. Webb

Argonne National Laboratory

P. O. Box 2528

Idaho Falls, ID 83403

Phone: (208) 533-7773 FAX: (208) 533-7403

Description:

The HFEF consists of a pair of adjoining shielded hot-cells measuring 70 ft long by 30 ft wide by 25 ft high, and 20 ft long by 30 ft wide by 25 ft high. The larger main cell is filled with argon gas, and is rated for plutonium handling. The smaller cell is filled with air, and is used mainly for maintenance of equipment. Many diverse capabilities exist within these cells for the handling and examination of nuclear fuels and irradiated reactor components. Long components are usually handled in a vertical attitude using deep pits in the cell floors.

Potential Use(s):

Without modification, the HFEF can be used for pre-and post-irradiation support and examination of highly radioactive materials. Numerous non-destructive testing capabilities exist, along with limited destructive methods including optical and electron microscopy. With suitable modification, many other services could be made available.

Keywords: Nuclear, Hot-cell, Remote examination

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: J. P. Webb
Phone: (208) 533-7773

Date Prepared: 2/01/1991
FAX: (208) 533-7403

Zero Power Physics Reactor (ZPPR) Argonne National Laboratory - West Idaho National Engineering Laboratory Idaho Falls, ID 83403	Richard E. Kaiser Argonne National Laboratory P. O. Box 2528 Idaho Falls, ID 83403 Phone: (208) 533-7461 FAX: (208) 533-7151																																				
Description: ZPPR is a large flexible critical facility for testing the physics properties of reactors. Space reactors, fast breeder reactors and gas-cooled fast reactors have been studied. The present assembly is a 14 ft by 14 ft stainless steel honeycomb split into two halves except during operation. The core site at the center of a 50 ft diameter concrete cylinder that is buried 20 ft under a large mound of earth, sand, and gravel. The reactor is presently in use but will be available in the future..																																					
Potential Use(s): The facility can be used for a wide range of physics tests on mock-up or actual reactor systems. Much experimental equipment is on hand and a trained staff of international experts is available. Keywords: Critical facility, reactor test, reactor physics, space reactors																																					
Required Modifications/Additions: To be defined based on specific project requirements.																																					
Status: OPERATIONAL <div style="display: flex; justify-content: space-between;"> Year Last Operated: 1991 Estimated Year Available: 1993 </div>																																					
Estimated Capital Cost: <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 10%;">FY</td> <td style="width: 10%;">92</td> <td style="width: 10%;">93</td> <td style="width: 10%;">94</td> <td style="width: 10%;">95</td> <td style="width: 10%;">96</td> <td style="width: 10%;">97</td> <td style="width: 10%;">98</td> <td style="width: 10%;">99</td> </tr> <tr> <td>\$M</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 10%;">FY</td> <td style="width: 10%;">00</td> <td style="width: 10%;">01</td> <td style="width: 10%;">02</td> <td style="width: 10%;">03</td> <td style="width: 10%;">04</td> <td style="width: 10%;">05</td> <td style="width: 10%;">06</td> <td style="width: 10%;">Total</td> </tr> <tr> <td>\$M</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>		FY	92	93	94	95	96	97	98	99	\$M									FY	00	01	02	03	04	05	06	Total	\$M								
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<div style="display: flex; justify-content: space-between;"> <div> Prepared by: S. G. Carpenter Phone: (208) 533-7459 </div> <div> Date Prepared: 1/31/1991 FAX: (208) 533-7151 </div> </div>																																					

Fuel Manufacturing Facility (FMF)	L. C. Walters
Argonne National Laboratory-West Idaho Falls, ID 83403	P. O. Box 2528 Idaho Falls, ID 83403 Phone: (208) 533-7384 FAX: (208) 533-7340

Description:
Category I, Fuel Fabrication Facility (enriched-uranium) 129 ft by 50 ft, second story 20 ft by 50 ft. (Original cost in 1986 1.6 M\$)

Potential Use(s):
Fuel fabrication pilot lines and pre-production runs.

Required Modifications/Additions:
To be defined based on specific project requirements.

Status: OPERATIONAL
Year Last Operated: 1990 Estimated Year Available: 1992

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. C. Walters
Phone: (208) 533-7384

Date Prepared: 2/04/1991
FAX: (208) 533-7340

Aerosol Laboratory
ANL, Bldg. 208, Rm D101
Argonne National Laboratory
Argonne, IL 60439

Vincent J. Novick
Argonne National Laboratory
Engineering Physics Division
Argonne, IL 60439
Phone: (708) 972-6629 FAX: (708) 972-4007

Description:

The Aerosol Laboratory (AL) is capable of investigating a wide range of aerosol phenomena. In addition to commercial aerosol generators and sampling systems, the AL has 2 vacuum chambers (1.5m long by 0.9m in diameter) with more than 15 ports each for various 'in situ' or extractive sampling geometries. Also available are spray droplet and powder dispensing devices for vacuum applications. Instrumentation including mass flow meters, pressure transducers, thermocouples, electrometers, and other measurement devices and systems are available.

Potential Use(s):

The aerosol laboratory can be utilized for the development and testing of new aerosol generators, sampling or monitoring devices under a variety of environmental conditions. It may also be used to simulate dust laden environmental conditions for component testing. Experimental pressure ranges of 10⁻⁵ torr to atmosphere, temperature up to 1200° C, humidities up to and including saturated and electrostatic potentials up to ± 50 kV, are some of the varied environmental test conditions available.

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Vincent J. Novick
Phone: (505) 845-7024

Date Prepared: 7/22/1991
FAX: (505) 845-7763

Fast Flux Test Facility
Westinghouse Hanford Company
Hanford, WA

Dale Dutt
Westinghouse Hanford Company
P.O. BOX 1970 MS: LS-60
Richland, WA
Phone: (509) 376-9336 FAX: (509) 376-9964

Description:

The fast flux test facility, FFTF, is a 400 MW(t) liquid metal cooled test reactor. It is the newest, most flexible test reactor available in the US. Available and proven capabilities include test assemblies capable of operating up to 1500K with temperature control. The reactor was designed with three test loops independent from the primary coolant loop. These loops, design to perform off normal and failure testing were not activated. The SP100 and Thermonics program have or are conducting tests in the reactor.

Potential Use(s):

Fuels and materials supporting liquid metal cooled NEP concepts can be tested in existing hardware. Materials test supporting NTP concepts can be conducted with minor hardware redesign. Because of the size of the core, conceptual designs exist for both a Li loop and a gas loop using one of the independent loops. The potential exists to tailor the core and use the reactor as a "driver core" to test NTP fuels.

Required Modifications/Additions:

None for near term fuels and materials testing. If it were to act as a driver core for NTP fuels, design and installation of a gas loop will need to be completed.

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1995

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Dale Dutt
Phone: (509) 376-9336

Date Prepared: 1/31/1991
FAX: (509) 376-9964

SP100 Ground Test Facility
Westinghouse Hanford Company

Hanford, WA

Dale Dutt
Westinghouse Hanford Company
P.O.Box 1970 MS:LS-60
Richland, WA 99352
Phone: (509) 376-9336 FAX: (509) 376-9964

Description:

The containment building selected to house the SP-100 test was previously used to test the 70 MW(t) Plutonium Recycle Test Reactor. The design for facility modifications is 50% complete and the vacuum system 60% complete. The 2.5 MW(t) dump heat exchanger and electrical control systems are on site. Approximately \$7M worth of equipment has been procured for the site

Potential Use(s):

NEP reactor and integrated system testing

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: Under Repair

Year Last Operated: 1991

Estimated Year Available: 1997

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Dale Dutt
Phone: (509) 376-9336

Date Prepared: 1/30/1991
FAX: (509) 376-9964

Hot Cell Examination Facilities
Westinghouse Hanford Company
Hanford, WA

Dale Dutt
Westinghouse Hanford Company
P.O. BOX 1970 MS: LS 60
Richland, WA 99352
Phone: (509) 376-9336 FAX: (509) 376-9964

Description:

The Hanford Hot Cells consist of three buildings. The 324 building contains large cells for disassembly and examination of components. The 327 building contains eight hot cells for detailed destructive examination of fuels. The 325 building houses the radiochemistry and microprobe laboratory. Capabilities exist for complete dimensional, chemical, mechanical, electrical, and thermal characterization of fuels and materials. The SP100 & thermionic fuels & materials irradiation tests are under examination in these facilities.

Potential Use(s):

Irradiated fuels and materials examination; post test examination of contaminated components; and test engine disassembly

Required Modifications/Additions:

None - Specific examination equipment may need to be acquired and installed in the cells.

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Dale Dutt
Phone: (509) 376-9336

Date Prepared: 1/30/1991
FAX: (509) 376-9964

Aerosol Safety Facility
Westinghouse Hanford Company
Hanford, WA 99352

Dale Dutt
Westinghouse Hanford Company
P.O. Box 1970 MS: LS-60
Richland, WA 99352
Phone: (509) 376-9336 FAX: (509) 376-9964

Description:

The 221T building was used by the Liquid Metal Reactor Program to conduct a full range of sodium, lithium, and NaK fire safety tests. Because of these tests, the facility has extensive safety and environmental protection systems.

Potential Use(s):

Liquid metal safety testing for NEP concepts; effluent scrubber development/demonstration tests for NTP concepts.

Required Modifications/Additions:

Hydrogen handling safety systems would need to be installed.

Status: Standby

Year Last Operated: 1989

Estimated Year Available: 1994

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Dale Dutt
Phone: (509) 376-9336

Date Prepared: 1/31/1991
FAX: (509) 376-9964

Critical Mass Laboratory
Westinghouse Hanford Company
Hanford, WA

Dale Dutt
Westinghouse Hanford Company
P.O.BOX 1970 MS: LS-60
Richland, WA 99352
Phone: (509) 376-9336 FAX: (509) 376-9964

Description:

The laboratory consists of a 35 x 35 x 20 foot room to perform criticality testing. A feasibility study was performed on re-establishing the high temperature Lalters Test Reactor in the facility to allow measurement of the temperature coefficient for graphite cores.

Potential Use(s):

Core physics testing in support of the liquid, vapor and gas core concepts

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: STANDBY

Year Last Operated: 1991

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Dale Dutt
Phone: (509) 376-9336

Date Prepared: 1/30/1991
FAX: (509) 376-9964

Hanford Metal Working Facility
Westinghouse Hanford Company

Hanford, WA

Dale Dutt
Westinghouse Hanford Company
P. O. BOX 1970 MS: LS-60
Richland, WA 99352
Phone: (509) 376-9336 FAX: (509) 376-9964

Description:

The Hanford Metal Working Facility was previously used to extrude the fuel elements for "N" - Reactor. It has a large capacity extrusion press, draw bench, 60 ft hone, 6 ft centerless grinder, autoclave, chemical dip tanks, furnace, and NDE inspection capability.

Potential Use(s):

Production of advanced cermet or metal fuels for NEP and NTP.

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: STANDBY

Year Last Operated: 1984

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Dale Dutt
Phone: (509) 376-9336

Date Prepared: 1/30/1991
FAX: (509) 376-9964

Radiation Effects Facility (REF)	C. L. Snead
Brookhaven National Laboratory Upton, NY 11973	Brookhaven National Laboratory Upton, NY 11973 Phone: (516) 282-3502 FAX: (516) 282-5266

Description:
Utilizes a 200 MeV proton LINAC (Linear Accelerator) for radiation effects studies.

Potential Use(s):
High energy proton interaction cross section measurements of potential shielding materials. Measurements needed for design of space craft. Facility can also be used for verification of shielding designs. Facility can be used for the investigation of radiation damage studies on electronic and computer components.

Required Modifications/Additions:
To be defined based on specific project requirements.

Status: Operational
Year Last Operated: 1990 Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Walter Y. Kato
Phone: (516) 282-2444

Date Prepared: 2/05/1991
FAX: (516) 282-5266

High Flux Beam Reactor (HFBR) Brookhaven National Laboratory Upton, NY 11973	M. Brooks Brookhaven National Laboratory Upton, NY 11973 Phone: (516) 282-4061 FAX: (516) 282-5266																																				
Description: 60 MW Heavy Water Moderated, highly enriched uranium fueled research reactor. Max thermal neutron flux about 2×10^{15} cm ² /sec Also gamma irradiation facility available.																																					
Potential Use(s): Radiation damage studies on materials Cross section measurements.																																					
Required Modifications/Additions: To be defined based on specific project requirements.																																					
Status: OPERATIONAL <div style="display: flex; justify-content: space-between;"> Year Last Operated: 1990 Estimated Year Available: 1991 </div>																																					
Estimated Capital Cost: <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 10%;">FY</td> <td style="width: 10%;">92</td> <td style="width: 10%;">93</td> <td style="width: 10%;">94</td> <td style="width: 10%;">95</td> <td style="width: 10%;">96</td> <td style="width: 10%;">97</td> <td style="width: 10%;">98</td> <td style="width: 10%;">99</td> </tr> <tr> <td>\$M</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 10%;">FY</td> <td style="width: 10%;">00</td> <td style="width: 10%;">01</td> <td style="width: 10%;">02</td> <td style="width: 10%;">03</td> <td style="width: 10%;">04</td> <td style="width: 10%;">05</td> <td style="width: 10%;">06</td> <td style="width: 10%;">Total</td> </tr> <tr> <td>\$M</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>		FY	92	93	94	95	96	97	98	99	\$M									FY	00	01	02	03	04	05	06	Total	\$M								
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Alternating Gradient Synchrotron (AGS) Brookhaven National Laboratory Upton, NY 11973	D. Lowenstein Brookhaven National Laboratory Upton, NY 11973 Phone: (516) 282-4611 FAX: (516) 282-5266																																				
Description: A facility for the production of 30 GeV protons and up to 1.6 GeV per nucleon heavy ions,																																					
Potential Use(s): Measurement of high energy proton interaction cross sections for spacecraft shielding materials. Verification studies of spacecraft shielding designs.																																					
Required Modifications/Additions: To be defined based on specific project requirements.																																					
Status: OPERATIONAL <div style="display: flex; justify-content: space-between;"> Year Last Operated: 1990 Estimated Year Available: 1991 </div>																																					
Estimated Capital Cost: <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 10%;">FY</td> <td style="width: 10%;">92</td> <td style="width: 10%;">93</td> <td style="width: 10%;">94</td> <td style="width: 10%;">95</td> <td style="width: 10%;">96</td> <td style="width: 10%;">97</td> <td style="width: 10%;">98</td> <td style="width: 10%;">99</td> </tr> <tr> <td>\$M</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 10%;">FY</td> <td style="width: 10%;">00</td> <td style="width: 10%;">01</td> <td style="width: 10%;">02</td> <td style="width: 10%;">03</td> <td style="width: 10%;">04</td> <td style="width: 10%;">05</td> <td style="width: 10%;">06</td> <td style="width: 10%;">Total</td> </tr> <tr> <td>\$M</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>		FY	92	93	94	95	96	97	98	99	\$M									FY	00	01	02	03	04	05	06	Total	\$M								
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Booster Applications Facility (BAF)

P. Thieberger

Brookhaven National Laboratory
Upton,, NY 11973

Brookhaven National Laboratory
Upton, NY 11973
Phone: (516) 282-4004 FAX: (516) 282-5266

Description:

A facility for extracting and utilizing heavy ion beams with energies up to 1.6 GeV per nucleon.

Potential Use(s):

Investigation of biological effects of galactic radiation. Measurement of heavy ion interaction cross sections for spacecraft shielding materials. Verification studies of spacecraft shielding designs.

Required Modifications/Additions:

Proposed new facility.

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Walter Y. Kato
Phone: (516) 282-2444

Date Prepared: 2/05/1991
FAX: (516) 282-5266

Space Environment Facility (SPEF)
Phillips Laboratory

Edwards AFB, CA 93523

Lt. Tim Lawrence

OLAC PL/LSVF

Building 8350

Edwards AFB, CA 93523

Phone: (805) 275-5640 FAX: (805) 275-5144

Description:

Chamber size: 30 ft diameter sphere; Access openings: 19 ft dia. lift off top 8 ft dia. hinged door at equator; Max. test article size: 16 ft x 16 ft x 20 ft high; Max test article weight: 100,000 lbs; Attachment points: 4 on top and 4 on bottom - Each point is a stainless steel vertical post approx. 8 ft from the vertical center line; cryogenic panels: 6 banks of independantly controllable panels, 4 con cave vertical banks around the inside peimeter with 9 panels per set, 2 flat horizontal banks-one attached to the top lid and the other on the bottom of the chamber.

Potential Use(s):

Environmental capability: Vacuum: 1 micro torr (650,000 ft) thermal wall temperature: -300 deg F. Radiant heat input: Max 200 watts/Sg ft from infrared lump array.

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Lt. Tim Lawrence
Phone: (805) 275-5640

Date Prepared: 2/06/1991
FAX: (805) 275-5144

Solar Thermal Propulsion Rocket
Test Facility
Phillips Laboratory
Edwards AFB, CA 93523

Lt. Tim Lawrence

OLAC PL/LSVF Building 8350
Edwards AFB, CA 93523
Phone: (805) 272-5640 FAX: (805) 275-5144

Description:

The Phillip's Laboratory has been doing subscale tests on a solar thermal propulsion rocket for many years. The current facility is capable of supplying 25 kw of continuous power to the hydrogen gas. The facility takes in the sun's energy from a heliostat, reflects it into a 10,000: 1 off-axis parabolic concentrator, which then focuses the energy into the thrust chamber.

Potential Use(s):

Hot hydrogen material tests (subscale due to power limitations)

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Lt. Tim Lawrence
Phone: (805) 275-5640

Date Prepared: 2/06/1991
FAX: (805) 275-5144

LOX/Hydrogen Rocket Engine
Component Test Facility
Phillip's Laboratory
Edwards AFB, CA 93523

Lt. Tim Lawrence
OLAC PL/LSUF
Building 8350
Edwards AFB, CA 93523
Phone: (805) 275-5640 FAX: (805) 275-5144

Description:

This facility will enable research and technology development for a one-half million pound thrust liquid hydrogen/liquid oxygen rocket engine thrust chamber for the Advanced Launch System (ALS) project.

Potential Use(s):

Cold flow testing of rocket engine components

Required Modifications/Additions:

An approach using existing government-owned equipment and facility infrastructure is reducing funding requirements significantly. This includes the utilization of existing high pressure gas cascades, run tanks, test stand structure, and existing control buildings. Ultimately a facility worth \$65M will be provided for about \$33 M.

Status: STANDBY

Year Last Operated: 1991

Estimated Year Available: 1993

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Lt Tim Lawrence
Phone: (805) 275-5640

Date Prepared: 2/06/1991
FAX: (805) 275-5144

Exhaust Containment Test Facility Phillips Laboratory Edwards AFB, CA 93523	Lt. Tim Lawrence OLAC PL/LSVF Building 8350 Edwards AFB, CA 93523 Phone: (805) 275-5640 FAX: (805) 275-5144																																				
Description: The facility is designed for testing Beryllium Solid Rocket Motors up to 50k thrust with 100% exhaust product containment. Requires a 3 hour pump down to 0.15 psia. Manpower requirements are less than required for steam jet ejector vacuum pump systems. Solid products of combustion can be collected and disposed of in a safe manner. All effluents can be sampled. Test item can be room temperature conditioned.																																					
Potential Use(s): Testing of hazardous chemical species that may be needed for erosion/corrosion experiments in the nuclear propulsion program.																																					
Required Modifications/Additions: To be defined based on specific project requirements.																																					
Status: Deactivated <div style="display: flex; justify-content: space-between;"> Year Last Operated: 1990 Estimated Year Available: 1991 </div>																																					
Estimated Capital Cost: <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 10%;">FY</td> <td style="width: 10%;">92</td> <td style="width: 10%;">93</td> <td style="width: 10%;">94</td> <td style="width: 10%;">95</td> <td style="width: 10%;">96</td> <td style="width: 10%;">97</td> <td style="width: 10%;">98</td> <td style="width: 10%;">99</td> </tr> <tr> <td>\$M</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 10%;">FY</td> <td style="width: 10%;">00</td> <td style="width: 10%;">01</td> <td style="width: 10%;">02</td> <td style="width: 10%;">03</td> <td style="width: 10%;">04</td> <td style="width: 10%;">05</td> <td style="width: 10%;">06</td> <td style="width: 10%;">Total</td> </tr> <tr> <td>\$M</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>		FY	92	93	94	95	96	97	98	99	\$M									FY	00	01	02	03	04	05	06	Total	\$M								
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Electric Propulsion Laboratory (EPL)
Phillips Laboratory

Edwards AFB, CA 93523

Lt. Tim Lawrence

OLAC PL/LSVF

Building 8350

Edwards AFB, CA 93523

Phone: (805) 275-5640 FAX: (805) 275-5144

Description:

The EPL consists of an 8 ft dia by 15 ft long vacuum tank capable of testing pulsed MPD thrusters up to 16 MW for .002 seconds; two 6ft dia by 10 ft long vacuum tanks each capable of testing NH3 arc jets up to 100 kwe (testing with hydrogen planned for the future); and one 16 ft dia by 40 ft long tank is under construction to test steady state MPD operation at 400 kwe with argon. Future upgrades will enable use of hydrogen or alkiline metal propellants.

Potential Use(s):

MPD thruster development, ion thruster development

Keywords: Electric propulsion, MPD or ion thruster development

Required Modifications/Additions:

Presently under construction

Status: Standby

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Lt. Tim Lawrence
Phone: (805) 275-5640

Date Prepared: 2/06/1991
FAX: (805) 275-5144

F1 Engine Static Test Stand EP4696
NASA - Marshall Space Flight Center
Huntsville, AL 35812

Don Donald
EP71
Marshall Space Flight Center
Huntsville, AL 35812
Phone: (205) 544-4103 FAX: (205) 544-7454

Description:

The F1 Engine Test Stand is a vertical engine firing test stand, 239 feet in elevation and 4,600 ft² in area at the base. Capability is provided for static firing of 1.5 million pound thrust RP-1/LOX engines. With modifications, the stand could accommodate engines with thrust levels up to 3.0 million pounds. Future plans include near-term modifications to add liquid hydrogen capability. The stand could then be utilized as an advanced high-capacity cold flow facility.

Potential Use(s):

Potential uses include static firing of nuclear (non-fissioning heat source) stages and cold flow testing of nuclear stage hardware.

Keywords: Static firing, nuclear thermal propulsion, cold flow testing, static test stand

Required Modifications/Additions:

Modifications/additions include a hydrogen heat source to simulate nuclear fission heating and mechanical stand modifications for installation of the nuclear stage and/or components.

Status: UNDER REPAIR

Year Last Operated: 1975

Estimated Year Available: 1993

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 971-9475

LH-2 Slosh Test Facility
EP4557
NASA - Marshall Space Flight Center
Huntsville, AL 35812

Don Donald
EP71
Marshall Space Flight Center
Huntsville, AL 35812
Phone: (205) 544-4103 FAX: (205) 544-7454

Description:

The facility is located in a 24 by 24 ft. base, 96 ft high extension of the Dynamic Structural Test Stand. The facility provides for LH-2 research and development tests in the areas of tank pressurization, stratification, sloshing, tank phenomena, and line recirculation. The slosh frequency is 0.0 to 0.7 Hz and the slosh displacement is 8 inches peak to peak.

Potential Use(s):

Potential uses for this facility are development tests for the nuclear engine hydrogen tankage system including tank pressurization, stratification, sloshing, tank phenomena, and line recirculation.

Keywords: hydrogen tank, propellant storage, sloshing, stratification, propellant tankage development

Required Modifications/Additions:

Use of this facility will require extensive refurbishment.

Status: DEACTIVATED

Year Last Operated: 1977

Estimated Year Available: 1994

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 971-9475

Propulsion Components Test Facility
EP4522
NASA - Marshall Space Flight Center
Huntsville, AL 35812

Don Donald
EP71
Marshall Space Flight Center
Huntsville, AL 35812
Phone: (205) 544-4103 FAX: (205) 544-7454

Description:

The test facility is a multipurpose, dual position test facility designed for hazardous testing of liquid hydrogen and liquid oxygen propulsion components and subsystems. One test position has a high superstructure with lines and tankage for testing LOX or LH2 turbopumps, while the other position is adaptable to pressure fed combustion devices.

Potential Use(s):

Potential uses include cold flow testing of turbopumps and other related subsystems.

Keywords: propulsion subsystem testing, turbopump testing, propulsion components testing, hydrogen cold flow

Required Modifications/Additions:

To be defined based on specific test requirements

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 971-9475

Van de Graaff Accelerator Facility EH4623 NASA - Marshall Space Flight Center Huntsville, AL 35812	F. J. Dolan EH11 Marshall Space Flight Center Huntsville, AL 35812 Phone: (205) 544-2512 FAX: (205) 544-5877
---	--

Description:
 The 1,720 sq. ft. facility is designed for the 2.5 MeV Van de Graaff positive ion accelerator, and consists of an accelerator room and a control room. The accelerator can produce beams of protons, deuterons, and electrons directly; and, through the use of suitable targets, can yield neutron and photon (Bremstrahlung gamma ray) fluxes. A shielded neutron cave and moderator have been installed to permit neutron radiography NDE studies using standard photographic film techniques and/or a closed circuit TV system.

Potential Use(s):
 Potential uses include radiation effects testing of nuclear engine materials and sensors.

Keywords: radiation effects, materials for nuclear engines, materials testing, nuclear engine sensors development

Required Modifications/Additions:
 To be defined based on specific test requirements.

Status: OPERATIONAL
 Year Last Operated: 1990 Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill Date Prepared: 3/01/1991
 Phone: (205) 971-9329 FAX: (205) 971-9475

Hydrogen Flow Facility EPHFF NASA - Marshall Space Flight Center Huntsville, AL 35812	Don Donald EP71 Marshall Space Flight Center Huntsville, AL 35812 Phone: (205) 544-4103 FAX: (205) 544-7454																		
Description: The Hydrogen Flow Facility is a facility for testing propulsion system components with LH2 at flowrates up to 10,000 gpm.																			
Potential Use(s): Nuclear propulsion system component testing at flowrates of LH2 described above Keywords: nuclear engine component testing, liquid hydrogen																			
Required Modifications/Additions: To be defined based on specific test requirements																			
Status: UNDER REPAIR <div style="display: flex; justify-content: space-between;"> Year Last Operated: 1990 Estimated Year Available: 1992 </div>																			
Estimated Capital Cost:																			
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Hot Hydrogen Tester (HHT)
EPHHTF
NASA - Marshall Space Flight Center
Huntsville, AL 35812

Tom Byrd
EP53
Marshall Space Flight Center
Huntsville, AL 35812
Phone: (205) 544-7147 FAX: (205) 544-7400

Description:

The HHT is for non-nuclear testing of reactor core elements, critical engine components, and candidate nuclear engine materials in a 1500 psia, 5000 F flowing hydrogen gas environment. The HHT is being designed for oscillatory and blow-down modes.

Potential Use(s):

Non-nuclear testing of reactor core elements, critical engine components, and any engine materials that require high pressure, high temperature hydrogen environment development.

Keywords: hot hydrogen testing, core elements, materials development, nuclear thermal propulsion

Required Modifications/Additions:

To be defined based on specific test requirements

Status: DEACTIVATED

Year Last Operated: 1974

Estimated Year Available: 1994

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 971-9475

S-1C Stage Static Test Tower/Advanced
Engine Test Facility (AETF) EP4679
NASA - Marshall Space Flight Center
Huntsville, AL 35812

Don Donald
EP71
Marshall Space Flight Center
Huntsville, AL 35812
Phone: (205) 544-4103 FAX: (205) 544-7454

Description:

The S-1C Static Test Stand is a vertical stand, 406 feet in elevation (including the derrick boom). Capability is provided for static firing of 7.5 million pound thrust stages. In 1988 modifications were completed which allow single-engine testing with advanced components on the SSME. The resulting LOX/LH-2 facility, now designated as the Advanced Engine Test Facility, is presently used for SSME Technology Tests. Design provisions have also been made to accomodate future gimbaling test requirements.

Potential Use(s):

Potential uses include static firing of nuclear (non-fissioning heat source) stages, cold flow testing of nuclear stage hardware, and integrated testing of propulsion systems including TVC subsystems.

Keywords: static firing, nuclear thermal propulsion, cold flow testing, static test stand

Required Modifications/Additions:

Modifications/additions include a hydrogen heat source to simulate nuclear fission heating and mechanical stand modifications for installation of the nuclear stage and/or components.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 971-9475

Propulsion Components Test Facility
(Facility EP4522)
NASA - Marshall Space Flight Center
Huntsville, AL 35812

Don Donald
EP71
Marshall Space Flight Center
Huntsville, AL 35812
Phone: (205) 544-4103 FAX: (205) 544-7454

Description:

The test facility is a multipurpose, dual position test facility designed for hazardous testing of liquid hydrogen and liquid oxygen propulsion components and subsystems. One test position has a high superstructure with lines and tankage for testing LOX or LH2 turbopumps, while the other position is adaptable to pressure fed combustion devices.

Potential Use(s):

Required Modifications/Additions:

Status: Operational

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 971-9475

Drop Tower Facility (Facility ES4550.2)

NASA - Marshall Space Flight Center
Huntsville, AL 35812

G.H. Fichtl

ES01

Marshall Space Flight Center
Huntsville, AL 35812

Phone: (205) 544-5506 FAX: (205) 544-9243

Description:

The Drop Tower Facility is designed to provide a simulated low gravity force field for R&D experiments. Each test experiment is housed within a 24 ft. long drag shield which protects the test package from the forces of drag during free fall. The shield is guided by two rails during its drop of 296 ft. Deceleration of the drag shield and test package result when the shield enters an open 40 ft. long cylindrical tube. The air compresses within the tube and thereby provides the stopping force for the shield. Instrumentation is provided by telemetry.

Potential Use(s):

To be determined by nuclear vehicle experimental requirements

Keywords: Drop tower, zero-g testing

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 947-5000

Cryogenic Instrumentation Laboratory (Facility ES4481.8) NASA - Marshall Space Flight Center Huntsville, AL 35812	G. H. Fichtl ES01 Marshall Space Flight Center Huntsville, AL 35812 Phone: (205) 544-5506 FAX: (205) 544-9243
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Description:

This laboratory includes liquid helium dewars, high vacuum pumps with large pumping capacities, and a magnetic/static shielded room with precision electronics for the development and testing of advanced electronic and mechanical instrumentation for use at cryogenic temperatures.

Potential Use(s):

Development and testing of electronics and instrumentation for use in cryogenic environments.

Keywords: Electronics, cryogenic instrumentation, instrumentation development and testing

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 971-9475

Nuclear Instrumentation Laboratory
(Facility ES4481.7)
NASA - Marshall Space Flight Center
Huntsville, AL 35812

G. H. Fichtl
ES01
Marshall Space Flight Center
Huntsville, AL 35812
Phone: (205) 544-5506 FAX: (205) 544-9243

Description:

The laboratory is comprised of equipment and facilities to perform experimental research on cosmic rays and in gamma ray astronomy, and to develop certain selected areas of nuclear instrumentation. Nuclear particle detectors (scintillators, Cerenkov counters, gas filled detectors) and assemblies of these detectors in cosmic ray and gamma ray telescopes are developed, functionally tested, and calibrated using radioactive sources and cosmic ray muons. Low level induced radioactivity from proton and neutron activation is measured.

Potential Use(s):

Develop and test low level radiation sensors and develop radiation measuring techniques for the nuclear environment of a nuclear thermal rocket.

Keywords: Radiation measurement, instrumentation

Required Modifications/Additions:

To be defined based on specific instrumentation requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 971-9475

Hydrogen Propellant Test Facility
(Stand 115) (Facility EP4583.4)
NASA - Marshall Space Flight Center
Huntsville, AL 35812

Don Donald
EP71
Marshall Space Flight Center
Huntsville, AL 35812
Phone: (205) 544-4103 FAX: (205) 544-7454

Description:

The facility is a multipurpose, dual position hydrogen/oxygen facility. Part of the facility is equipped to test model engines, hot gas devices; and cryogenic tanks. The other part of the facility was designed to calibrate liquid hydrogen flow meters and to generate and store "slush" hydrogen. A blast wall on two adjacent sides of the stand isolate these test setups. It is located approximately 200 ft. East of Bldg. 4583, which could provide instrumentation and control services.

Potential Use(s):

Non-nuclear test and calibration of engine propellant handling devices and tanks.

Keywords: Non-nuclear testing, cryogenic fluid handling device calibration, hydrogen turbopump testing.

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: STANDBY

Year Last Operated: 1974

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 971-9475

Vacuum Facility
Bldg 4583, East Test Area
Marshall Space Flight Center
Huntsville, AL 35812

Richard Eskridge
EP55
Marshall Space Flight Center
Huntsville, AL 35812
Phone: (205) 544-7119 FAX: (205) 544-7400

Description:

Large vacuum chamber about 8-1/2 feet in diameter and 14 feet long. The chamber is pumped by two roots blowers (frame sizes 1639 and 1024). These are backed by two model 912 stokes microvac pumps.

Potential Use(s):

Nozzle hydrogen dissociation and recombination test. Kinetic rate tests.
Low pressure warm hydrogen flow tests for turbine blades, mixers, etc

Required Modifications/Additions:

Refurbish seals. Install gauges. Build moveable support structure for chamber door. Modify electrical and control systems for use in hydrogen proximity.

Status: STANDBY

Year Last Operated: 1990

Estimated Year Available: 1992

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Tom Byrd
Phone: (205) 544-7147

Date Prepared: 4/05/1991
FAX: (205) 544-7400

Thermal Vacuum Chamber Facility
(Facility EP4557.4)
NASA - Marshall Space Flight Center
Huntsville, AL 35812

Don Donald
EP71
Marshall Space Flight Center
Huntsville, AL 35812
Phone: (205) 544-4103 FAX: (205) 544-7454

Description:

The Facility consists of a 15 by 20 ft. stainless steel vacuum chamber with associated vacuum pumping, thermal shroud, quartz lamp array and liquid hydrogen system. The chamber's thermal shroud and cryopumping array are supplied with liquid nitrogen from an LN2 subcooler. The ultimate pressure with diffusion pumps is 10⁻⁷ torr and with cryopumping is 10⁻⁹ torr. The facility is rated for hazardous testing with liquid hydrogen.

Potential Use(s):

Non-nuclear testing of engine and spacecraft subsystems at simulated altitude conditions.

Keywords: Non-nuclear engine components testing, vacuum simulation, subsystems altitude testing

Required Modifications/Additions:

A major refurbishment of the facility will be required prior to utilization.

Status: STANDBY

Year Last Operated: 1983

Estimated Year Available: 1995

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 971-9475

Drop Tube Facility (Facility ES4550.3)

NASA - Marshall Space Flight Center
Huntsville, AL 35812

G. H. Fichtl

ES01

Marshall Space Flight Center
Huntsville, AL 35812

Phone: (205) 544-5506 FAX: (205) 924-3000

Description:

The Drop Tube is located adjacent to the Drop Tower and is utilized to perform low gravity tests on different materials in support of materials processing in space programs. Material samples are melted in a furnace at the top of a 10 in. diameter, 100 meter, vertical evacuated tube. A device in the furnace releases the molten material as a droplet. The droplet solidifies as it free falls the length of the tube. The sample is then recovered and analyzed. The facility is used to develop material processing techniques that will be used in space flights.

Potential Use(s):

To be determined by nuclear vehicle experimental requirements.

Keywords: Drop tower, zero-g testing, non-nuclear materials testing

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 971-9475

Scanning Electron Microscope Facility
(Facility ES4481.13)
NASA - Marshall Space Flight Center
Huntsville, AL 35812

G. H. Fichtl
ES01
Marshall Space Flight Center
Huntsville, AL 35812
Phone: (205) 544-5506 FAX: (205) 544-9243

Description:

This Scanning Electron Microscope has a minimum resolution of 100 angstroms and a range of magnification continuous from 70X-50,000X. Samples may be held at temperatures from -195°C to 400°C by use of appropriate stages. A useable sample size is 0.5 in. diameter X 2 in. high. Stereomicrographic pairs of photographs may be made to enable presentation of topographic information. Secondary and back scattered images are available for display by video or photograph (Polaroid). Coating is available for preparation of nonconductive and biosamples.

Potential Use(s):

Post-test examination of materials/components used in nuclear engine testing or radiation bombardment to simulate nuclear engine environment. The radiation damage to different materials can be assessed and quantified.

Keywords: Scanning electron microscope, radiation damage to materials, materials testing

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 971-9475

Teleoperator and Robotics Evaluation
Facility (Facility EB4619.1)
NASA Marshall Space Flight Center
Huntsville, AL 35812

J. H. Newton
EB01
Marshall Space Flight Center
Huntsville, AL 35812
Phone: (205) 544-5517 FAX: (205) 544-5841

Description:

The Teleoperator and Robotics Evaluation Facility is an integrated test and simulation facility for evaluating the performance of remotely-managed systems such as free-flying teleoperators, orbital maneuvering vehicles, and similar spacecraft controlled from a remote control station.

Potential Use(s):

Potential uses include the engineering of remotely operated machinery (robotics) for servicing nuclear engines and engine components during missions.

Keywords: Automated equipment development, robots, remote servicing

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 971-9475

Shuttle Main Engine Simulation
Laboratory (Fac. EB4487.41)
NASA - Marshall Space Flight Center
Huntsville, AL 35812

J. H. Newton
EBo1
Marshall Space Flight Center
Huntsville, AL 35812
Phone: (205) 544-5517 FAX: (205) 544-5841

Description:

The Space Shuttle Main Engine (SSME) Flight Simulation Laboratory is presently being used for SSME flight systems integration, flight software validation, and system analysis. The hybrid simulation includes nonlinear engine dynamics, large signal dynamics, and quantization effect introduced by controlled and static firing data from engine tests. The final simulation incorporates flight sensors, actuators, valves, special interface units, and a flight engine controller for system verification tests.

Potential Use(s):

Nuclear thermal rocket engine test and flight simulations.

Key Words: Engine simulations, engine testing, engine development

Required Modifications/Additions:

Acquisition of nuclear thermal rocket engine sensors, valves, and special interface units, and the development of software to simulate the engine operation.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 971-9475

Thermal Instrumentation Development
Laboratory
NASA Marshall Space Flight Center
Huntsville, AL 35812

J. H. Newton
EB01
Marshall Space Flight Center
Huntsville, OH 35812
Phone: (205) 544-5517 FAX: (205) 544-5841

Description:

The facilities provide for development and evaluation of heating rate sensors and cryogenic temperature, liquid level, and proximity sensors.

Potential Use(s):

Nuclear thermal rocket engine sensors development for heat flux and cryogenic temperature level measurements.

Key Words: Sensors, cryogenics, heat flux measurement, instrumentation development

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 971-9475

Dynamic Structural Test Facility
(Facility ED4557.1)
NASA - Marshall Space Flight Center
Huntsville, AL 35812

G. B. Waggoner
ED71
Marshall Space Flight Center
Huntsville, AL 35812
Phone: (205) 544-1101 FAX: (205) 544-0236

Description:

The facility was designed to conduct mechanical and vibrational tests on fully assembled flight vehicles. The vehicle is suspended within the stand with springs and cables in such a manner as to make it similar to a free beam or seismic mass. Vibration loads can be induced in the pitch, yaw, or longitudinal axis to obtain resonance frequencies and bending modes. Checkout of vehicle mechanical mating features between stages can also be investigated.

Potential Use(s):

Mechanical and vibrational tests on assembled nuclear rocket vehicle to be defined.

Keywords: Mechanical testing, non-nuclear testing, vibrational testing

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: STANDBY

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 971-9475

Mated Vehicle Ground Vertical Test
Facility (Facility ED4550.1)
NASA Marshall Space Flight Center
Huntsville, AL 35812

G. B. Waggoner
Marshall Space Flight Center
ED 71
Huntsville, AL 35812
Phone: (205) 544-1101 FAX: (205) 544-0236

Description:

The NVGVT Test Stand was designed to conduct mechanical and vibrational tests on fully assembled flight vehicles as well as on separate flight configurations. The vehicle tests are performed on hydrodynamic supports which provide 6 degree-of-freedom movement that is required when dynamically testing large space vehicles. Vibration loads can be induced in the pitch, yaw, or longitudinal axis to obtain resonance frequencies and bending modes. Checkout of vertical mechanical mating features between stages can also be investigated.

Potential Use(s):

Mechanical and vibrational tests on assembled nuclear rocket vehicle to be defined.

Key Words: Mechanical testing, non-nuclear testing, vibrational testing

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: STANDBY

Year Last Operated: 1988

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 971-9475

Vacuum Plasma Spray Development
Facility (Facility EH4707.5)
NASA - Marshall Space Flight Center
Huntsville, AL 35812

F. J. Dolan
EH11
Marshall Space Flight Center
Huntsville, AL 35812
Phone: (205) 544-2512 FAX: (205) 544-5877

Description:

The 2,000 sq. ft. facility is designed and equipped to support research in the application of high temperature resistant and other special purpose coatings. This equipment can also be used to apply overlay coatings for protection against hydrogen embrittlement and for repairing eroded equipment.

Potential Use(s):

Potential uses include the engineering and evaluation of coating for the nuclear engine fuel elements and components.

Keywords: Fuel element coatings, coatings evaluation, engine components coatings

Required Modifications/Additions:

To be defined by specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 971-9475

Cryogenic Test Facility
(Facility EH4628.1)
NASA - Marshall Space Flight Center
Huntsville, AL 35812

F. J. Dolan
EH11
Marshall Space Flight Center
Huntsville, AL 35812
Phone: (205) 544-2512 FAX: (205) 544-5877

Description:

This facility provides the capability for testing materials in both liquid and gaseous hydrogen. The facility is designed with isolated test cells, hydrogen sensors and remote controls for safe operation. This facility is one of only a relatively few available in the United States in which gaseous hydrogen tests can be conducted at pressures up to 10,000 psi. The facility supports cryogenic testing of metallic and nonmetallic materials, hydrogen embrittlement testing and simulation tests for operating in a hydrogen service environment.

Potential Use(s):

Potential uses include the testing and evaluation of nuclear engine components and cryogenic tankage in a hydrogen environment.

Key Words: Non-nuclear testing, cryogenic testing, high pressure hydrogen, engine components testing

Required Modifications/Additions:

To be defined based on specific project test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 971-9475

Nondestructive Evaluation Facility (Facility EH4605.1) NASA - Marshall Space Flight Center Huntsville, AL 35812	F. J. Dolan EH11 Marshall Space Flight Center Huntsville, AL 358123 Phone: (205) 544-2512 FAX: (205) 544-5877
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Description:

The facility provides specialized laboratory equipment and instrumentation for the nondestructive evaluation of materials and structures. It is the only facility of this type in NASA. Radiographic, ultrasonic, electromagnetic, optical, holographic, x-ray diffraction, and mechanical testing systems are being used to develop new or improved methods and techniques for the detection and evaluation of flaws in various types of engineering materials and in welded and bonded structures.

Potential Use(s):

Nondestructive testing of materials for use in nuclear engines and spacecraft components. Could have special application for evaluation of materials to be used in the nuclear engine high radiation environment. Post-test analyses can be performed to determine the radiation effects on spacecraft materials.

Key Words: Materials testing, materials evaluation, nuclear environment effects

Required Modifications/Additions:

To be defined based on specific project test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 971-9475

Ceramics and Coatings Development
Laboratories (Facility EH4612.1)
NASA - Marshall Space Flight Center
Huntsville, AL 35812

F. J. Dolan
EH11
Marshall Space Flight Center
Huntsville, AL 35812
Phone: (205) 544-2512 FAX: (205) 544-5877

Description:

The laboratories provide diverse capabilities in the fields of coating application, measurement, testing and evaluation. The laboratories also have the capabilities to fabricate, process, and evaluate common as well as special ceramic materials. Equipment is provided for measuring fracture properties of glasses and ceramic materials. A high temperature insulation test facility where ceramic, organic foam, and ablative materials can be exposed to a programmed radiant heat flux while undergoing ascent pressurization is an additional capability.

Potential Use(s):

Developing and testing candidate fuel element coatings for nuclear engines.

Key Words: Non-nuclear materials development and testing, fuel element coatings development and testing.

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 947-5000

Composite Materials and Cryogenic
Insulation Laboratory (EH4612.3)
NASA - Marshall Space Flight Center
Huntsville, AL 35812

F. J. Dolan
EH11
Marshall Space Flight Center
Huntsville, AL 35812
Phone: (205) 544-2512 FAX: (205) 544-5877

Description:

These facilities possess the capability to perform theoretical and experimental research and development programs on polymeric materials for use as cryogenic insulations, composite materials, and adhesives as applied to spacecraft, launch vehicles, and related systems. Experimental programs are executed to determine the reliability, particularly with respect to the expected environment, and to improve or enhance the properties of polymers, particularly from the standpoint of structural, thermal, and insulation application.

Potential Use(s):

Potential uses include development of cryogen tankage insulations and adhesives for the nuclear vehicle.

Key Words: Non-nuclear development of materials, cryogen tankage insulation development, adhesives

Required Modifications/Additions:

To be defined by specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 971-9475

Chemistry Diagnostics Laboratory
(Facility EH4612.4)
NASA - Marshall Space Flight Center
Huntsville, AL 35812

F. J. Dolan
EH11
Marshall Space Flight Center
Huntsville, AL 35812
Phone: (205) 544-2612 FAX: (205) 544-5877

Description:

The chemistry laboratories investigate the properties of a wide variety of metallic and nonmetallic materials. Materials are characterized to determine the composition and conformance to appropriate specifications. In addition, physical determinations such as viscosity, density, and molecular weight are made on engineering materials. Methods of analysis are developed for special applications, and specialized instrumentation such as that required for trace contamination measurement or hazardous gas detection is developed.

Potential Use(s):

Non destructive testing of materials for use in nuclear engines and spacecraft components. Evaluation of materials after exposure to gamma and neutron radiation doses as would be seen in the nuclear engine environment.

Key Words: Materials testing, materials evaluation, nuclear environment effects

Required Modifications/Additions:

To be defined by specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1990
FAX: (205) 971-9475

Corrosion Protection and Control
Laboratory (Facility EH4612.9)
NASA - Marshall Space Flight Center
Huntsville, AL 35812

F. J. Dolan
Marshall Space Flight Center
EH11
Huntsville, AL 35812
Phone: (205) 544-2512 FAX: (205) 544-5877

Description:

The laboratory is equipped to conduct research and provide design data related to the performance of metal alloys under a variety of environmental conditions. This includes corrosion evaluation of metal alloys, corrosion fatigue studies, evaluation of the stress corrosion susceptibility of engineering alloys, studies on protective coatings, surface treatments, and inhibitors for mitigating corrosion of metal alloys, and determination of the extent of corrosion under environmental conditions expected for space vehicle components.

Potential Use(s):

Potential uses include the engineering and evaluation of nuclear engine fuel element coatings.

Key Words: Fuel element coatings, corrosion of coatings

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 971-9475

Propulsion Component Altitude Test
Facility (Facility EP4530.1)
NASA - Marshall Space Flight Center
Huntsville, AL 35812

Don Donald
EP71
Marshall Space Flight Center
Huntsville, AL 35812
Phone: (205) 544-4103 FAX: (205) 544-7454

Description:

The test facility is served by high pressure gases (GN-2, GHe, and Air), LOX or LN-2 storage, and transfer systems. Test position 301 has the capability of testing heat exchangers, combustors, valves, etc. Test position 302 has the capability for high vacuum test work such as: spacecraft components and subsystems, super insulated tanks, etc. Test position 303 is used for ambient thermal tests. Test position 304 is capable of combined environments, i.e., vacuum, heat, cryogenic exposure, etc.

Potential Use(s):

Testing Nuclear Thermal Rocket Engine components at simulated space conditions (pressure and temperature). Components such as valves, subscale turbopumps, tankage subsystems, and nozzles can be tested.

Key Words: Engine components testing, simulated altitude testing

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Keith M. Dill
Phone: (205) 971-9329

Date Prepared: 3/01/1991
FAX: (205) 971-9475

Hydrogen Environment Materials
Testing Laboratory
Marshall Space Flight Center
Huntsville, AL 35812

Bryan McPherson
Mail Code: EH -23
Marshall Space Flight Center
Huntsville, AL 35812
Phone: (205) 544-2601 FAX: (205) 544-5877

Description:

Capable of conducting tensile, creep, creep rupture, low cycle fatigue, high cycle fatigue, crack growth, and fracture toughness tests on material samples in a hydrogen environment (precharged or insitu) at temperatures ranging from ambient to 2000°F and at pressures up to 10,000 psi.

Potential Use(s):

Materials testing in support of the SEI nuclear propulsion project.

Keywords: Hydrogen environment materials testing

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 8/06/1991
FAX: (216) 826-6613

B-Complex (Dual Position Test Stand)
B-1 Test Position
NASA Stennis Space Center
SSC, MS 39529

Paul Rieder
Code FA 30 Building 1100
Stennis Space Center
SSC, MS 39529
Phone: (601) 688-1483 FAX: (601) 688-1485

Description:

The B-1 Engine Test Stand is a vertical engine firing test stand rated for a thrust capacity of 13-million pounds. The stand is designed for static firing of the Space Shuttle Main Engine producing 375,000 pounds of thrust and includes a self-pumping diffuser which simulates 65,000 feet of altitude. The facility is located adjacent to existing waterways providing propellant barge access supporting long duration, high flow rate, engine testing. The test stand is supplied with high pressure gases (GH₂, GN₂, GHe and Air), cryogenics (LH₂, LOX,) & Industrial water.

Potential Use(s):

Potential uses include engine integration testing, component safety testing, system-level safety testing, hot hydrogen flow testing, propulsion component altitude testing, and hydrogen propellant testing.

Keywords: Engine testing, engine integration, system testing, propellant system testing, hydrogen flow testing.

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Tracy Moragas
Phone: (601) 688-1823

Date Prepared: 7/25/1991
FAX: (601) 688-3769

B-Complex (Dual Position Test Stand)
B-2 Test Position
NASA Stennis Space Center
SSC, MS 39529

Paul Rieder
Code FA30 Building 1100
Stennis Space Center
SSC, MS 39529
Phone: (601) 688-1483 FAX: (601) 688-1485

Description:

The B-2 Engine Test Stand is a vertical engine firing test stand rated for a thrust capacity of 13-million pounds. The stand is designed for static firing of the Apollo/Saturn V first stage rocket engines producing 7.5 million pounds of thrust and for static firing of the Space Shuttle Propulsion System producing 1.125 million pounds of thrust. The facility is located adjacent to existing waterways providing propellant barge access supporting long duration, high flow rate, engine testing.

Potential Use(s):

Potential uses include engine integration testing, component safety testing, system-level safety testing, hot hydrogen flow testing, propulsion component altitude testing, hydrogen propellant testing.

Keywords: Engine testing, engine integration, system testing, propulsion testing, propellant system testing, hydrogen flow testing

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: STANDBY

Year Last Operated: 1980

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Tracy Moragas
Phone: (601) 688-1823

Date Prepared: 7/25/1991
FAX: (601) 688-3769

Component Test Facility NASA Stennis Space Center SSC, MS 39529	Paul Rieder Code FA 30 Building 1100 Stennis Space Center SSC, MS 39529 Phone: (601) 688-1483 FAX: (601) 688-1485																																				
Description: The facility consists of three 32' x 35' test cells designed for turbopump propulsion feed systems testing. Modifications would permit thrust chamber testing. The facility has industrial water service, high pressure gas systems (GHe, GH2, GN2), ultra-high pressure gas systems (15000 psi GH2 and GN2), cryogenic storage systems (LOX, LH2, LN2) and high pressure cryogenic transfer systems (8500 psi LN2 and LOX). Future plans include installation of an ultra-high pressure, high flow pumping system and a barge dock which will permit long duration testing.																																					
Potential Use(s): Potential facility uses include hot hydrogen flow testing, component testing without hot hydrogen or irradiation environment, component safety testing, system-level safety testing, engine integration testing, cryogenic systems testing. Keywords: cryogenic testing, component testing, component safety testing, non-nuclear component testing, turbopump development, propellant feed systems, thrust chamber development.																																					
Required Modifications/Additions: Modifications include the addition of a hydrogen heat source for hot hydrogen testing. Other modifications to be defined based on specific test requirements.																																					
Status: OPERATIONAL <div style="display: flex; justify-content: space-between;"> Year Last Operated: 1990 Estimated Year Available: 1991 </div>																																					
Estimated Capital Cost: <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 10%;">FY</td> <td style="width: 10%;">92</td> <td style="width: 10%;">93</td> <td style="width: 10%;">94</td> <td style="width: 10%;">95</td> <td style="width: 10%;">96</td> <td style="width: 10%;">97</td> <td style="width: 10%;">98</td> <td style="width: 10%;">99</td> </tr> <tr> <td>\$M</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 10%;">FY</td> <td style="width: 10%;">00</td> <td style="width: 10%;">01</td> <td style="width: 10%;">02</td> <td style="width: 10%;">03</td> <td style="width: 10%;">04</td> <td style="width: 10%;">05</td> <td style="width: 10%;">06</td> <td style="width: 10%;">Total</td> </tr> <tr> <td>\$M</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>		FY	92	93	94	95	96	97	98	99	\$M									FY	00	01	02	03	04	05	06	Total	\$M								
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<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> Prepared by: Paul Rieder Phone: (601) 688-1483 </div> <div style="width: 45%;"> Date Prepared: 7/25/1991 FAX: (601) 688-1485 </div> </div>																																					

Cryogenic Flow Facility
NASA Stennis Space Center
SSC, MS 39529

Paul Rieder
Code FA30 Bldg 1100
Stennis Space Center
SSC, MS 39529
Phone: (601) 688-2486 FAX: (601) 688-1485

Description:

This facility is designed for research and technology development of cryogenic systems, components and instrumentation. The flow facility is serviced by high pressure gases (GN₂, GHe, and Air) and LOX/LN₂ storage and run tanks. Cryogenic flow capabilities range up to 8000 gpm, and have durations of up to 15 minutes at lower flow rates. The facility is capable of instrumentation development, cryogenic testing, component thermal tests, and eventually vacuum research with cryogenics.

Potential Use(s):

Potential uses include thermal cycle degradation of components, valves, ducts, etc., Testing of nuclear thermal rocket engine components such as propellant seal leak detection and insulation material performance. Nuclear engine program tests such as LH₂ slosh tests, hydrogen propellant and engine integration tests, and instrumentation development.

Keywords: LH₂ slosh test, engine integration, propellant feed system, cold flow testing, nuclear thermal protection, instrumentation development

Required Modifications/Additions:

To be based on specific test requirements. Facility is readily adaptable.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Patrick Scheuermann
Phone: (601) 688-2486

Date Prepared: 7/25/1991
FAX: (601) 688-1485

Diagnostic Testbed Facility

NASA Stennis Space Center
SSC, MS 39529

Paul Rieder

Code FA30 bldg 1100
Stennis Space Center
SSC, MS 39529

Phone: (601) 688-2486 FAX: (601) 688-1485

Description:

This Facility supports technology development relating to small-scale liquid rocket engines. Testing is currently being performed on a 1200 pound thrust engine for evaluating the presence of metals resulting from degradation of engine components in the rocket plume. Technology development is also being conducted on cryogenic instrumentation & engine health monitoring systems. The facility includes an operations building; has industrial water service; high pressure gas (GH₂, GN₂) systems, and cryogenic LOX storage & transfer systems.

Potential Use(s):

Potential uses include nuclear thermal rocket engine non-nuclear component testing, component safety testing, and instrumentation development.

Keywords: Cryogenic testing, component testing, instrumentation development

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Paul Rieder
Phone: (601) 688-1483

Date Prepared: 7/25/1991
FAX: (601) 688-1485

Gas and Materials Analysis Laboratory
Nondestructive Evaluation/Testing Lab.
NASA Stennis Space Center
SSC, MS 39529

Paul Rieder
Code FA30 Bldg 1100
Stennis Space Center
SSC, MS 39529
Phone: (601) 688-2486 FAX: (601) 688-1485

Description:

State-of-the-art laboratories for support of gas and cryogenic analysis; contamination control; materials characterization; corrosion analysis; particle identification and analysis; unknown material identification; conventional x-ray inspection; microfocus fluoroscope inspection; ultrasonic shear wave flow detection; liquid penetrant inspection; hardness testing; leak testing; acoustic emission testing; ultrasonic thickness measurement; visual inspection.

Potential Use(s):

Material testing and characterization laboratories for nonradioactive materials proposed for structural components (ex. tie-rods, pressure vessels, etc.).

Keywords: Materials testing, materials characterization, nondestructive evaluation, cryogenics analysis, material and structures laboratories.

Required Modifications/Additions:

To be defined based upon specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Chuck Schimmel
Phone: (601) 688-3164

Date Prepared: 7/25/1991
FAX: (601) 688-3769

Propulsion Test Stand (401)

NASA-White Sands Test Facility
Las Cruces, NM 88004

David Harris

White Sands Test Facility

P. O. Drawer MM

Las Cruces, NM 88004

Phone: (505) 524-5522 FAX: (505) 524-5798

Description:

Test Stand 401 is a large rocket engine test stand currently equipped with hypergolic and cryogenic propellant systems. It is designed for testing engines up to 20,000 lbf thrust while maintaining a simulated altitude condition of over 100,000 ft. for a test duration up to 120 minutes, depending on engine thrust. Unlimited vacuum coast periods in excess of 200,000 ft is available using mechanical vacuum pumps. The test stand is 33 ft diameter by 38 ft high, designed for firing vertically downward.

Potential Use(s):

Because of its large size, Test Stand 401 is suitable for testing full scale nuclear thermal or electric rocket engine or systems.

Keywords: Nuclear thermal propulsion, nuclear electric propulsion, full scale component development.

Required Modifications/Additions:

As may be needed to support specific project test requirements.

Status: Operational

Year Last Operated: 1991

Estimated Year Available: 1992

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: David Harris
Phone: (505) 524-5522

Date Prepared: 2/05/1992
FAX: (505) 524-5798

Propulsion Test Stand (402)

White Sands Test Facility (WSTF)
Las Cruces, NM 88004

P. Baker

White Sands Test Facility

P. O. Drawer MM

Las Cruces, NM 88004

Phone: (505) 524-5522 FAX: (505) 524-5798

Description:

Test Stand 402 is an ambient test stand for vertical test-firing of engines up to the 25,000-pound thrust class. The stand is made of structural steel and is 33 ft square by 30 ft high. There are three working levels; an open below-grade level, and enclosed grade and upper levels. Test articles may be thermally conditioned in the range of 40 to 125°F. The stand also has a water-cooled flame deflector. The stand is currently being modified to test a 40,000 lbf cryogenic launch vehicle.

Potential Use(s):

Because of its large size, Test Stand 402 is an economical test option when simulated altitude conditions are not mandatory.

Keywords: Nuclear thermal propulsion, nuclear electric propulsion, full scale component development.

Required Modifications/Additions:

As may be needed to support specific project test requirements.

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1993

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: P. Baker
Phone: (505) 524-5522

Date Prepared: 2/06/1992
FAX: (505) 524-5798

Propulsion Test Stand (405)

White Sands Test Facility (WSTF)
Las Cruces, NM 88004

P. Baker

White Sands Test Facility

P. O. Drawer MM

Las Cruces, NM 88004

Phone: (505) 524-5522 FAX: (505) 524-5798

Description:

Test Stand 405 is a 9.5 ft. by 25 ft. horizontal test cell capable of testing 25,000lbf thrust engines at simulated altitude conditions in excess of 100,000 feet. The altitude systems consists of a chemical steam generator and a two-stage ejector set. Maximum steam system duration is 120 minutes, depending on engine thrust. Unlimited vacuum coast periods in excess of 200,000 ft. is available using mechanical vacuum pumps.

Potential Use(s):

Test Stand 405 is suitable for single engine developmental testing.

Keywords: Nuclear thermal propulsion, nuclear electric propulsion, full scale component development.

Required Modifications/Additions:

As may be needed to support specific project test requirements.

Status: Operational

Year Last Operated: 1991

Estimated Year Available: 1992

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: P. Baker

Phone: (505) 524-5522

Date Prepared: / /

FAX: (505) 524-5798

Detonation Test Facilities NASA White Sands Test Facility Las Cruces, NM 88004	Frank J. Benz NASA White Sands Test Facility P. O. Drawer MM Las Cruces, NM 88004 Phone: (505) 524-5722 FAX: (505) 524-5260																																				
Description: Chemical and cryogenic propellant hazard studies are currently conducted at the WSTF Detonation Test Facilities. These facilities provide the capabilities to investigate the ignition, thermal, explosion and detonation characteristics of many hazardous and cryogenic aerospace fluids. Future testing applications for nuclear propulsion systems utilizing hydrogen are anticipated.																																					
Potential Use(s): The WSTF Detonation Test Facility is primarily designed to evaluate the explosion and detonation characteristics of hydrazine and hydrogen/oxygen fluids. Future testing of hydrogen systems for nuclear propulsion development is anticipated. Keywords: Hazardous fluids, cryogenic fluids, ignition, explosion, detonation, aerospace fluids																																					
Required Modifications/Additions: To be defined based on specific project test requirements.																																					
Status: Operational Year Last Operated: 1991 Estimated Year Available: 1992																																					
Estimated Capital Cost: <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 10%;">FY</td> <td style="width: 10%;">92</td> <td style="width: 10%;">93</td> <td style="width: 10%;">94</td> <td style="width: 10%;">95</td> <td style="width: 10%;">96</td> <td style="width: 10%;">97</td> <td style="width: 10%;">98</td> <td style="width: 10%;">99</td> </tr> <tr> <td>\$M</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 10%;">FY</td> <td style="width: 10%;">00</td> <td style="width: 10%;">01</td> <td style="width: 10%;">02</td> <td style="width: 10%;">03</td> <td style="width: 10%;">04</td> <td style="width: 10%;">05</td> <td style="width: 10%;">06</td> <td style="width: 10%;">Total</td> </tr> <tr> <td>\$M</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>		FY	92	93	94	95	96	97	98	99	\$M									FY	00	01	02	03	04	05	06	Total	\$M								
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<div style="display: flex; justify-content: space-between;"> <div> Prepared by: Frank J. Benz Phone: (505) 524-5722 </div> <div> Date Prepared: 2/06/1992 FAX: (505) 524-5260 </div> </div>																																					

Large Scale Hydrogen/Oxygen Explosion
Test Facility
NASA White Sands Test Facility
Las Cruces, NM 88004

Frank J. Benz
NASA White Sands Test Facility
P. O. Drawer MM
Las Cruces, NM 88004
Phone: (505) 524-5722 FAX: (505) 524-5260

Description:

The Large Scale Hydrogen/Oxygen Explosion Test Facility is located in a remote area of the White Sands Test Facility and provides a test system for determining yields from explosive type tests. Tests can be performed where the explosive yield is as great as 500 pounds of TNT. Extensive instrumentation and data acquisition systems are in place and available.

Potential Use(s):

The LSHOE test facility is being developed as part of program to assess the yield of a large scale hydrogen/oxygen explosion in support of the shuttle and heavy lift vehicles. Future explosion testing of hydrogen systems for nuclear propulsion development could be conducted at this facility.

Required Modifications/Additions:

Within the limits specified, no modifications are necessary except for those unique to a particular test program.

Status: Operational

Year Last Operated: 1991

Estimated Year Available: 1992

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Frank J. Benz
Phone: (505) 524-5722

Date Prepared: 2/06/1992
FAX: (505) 524-5260

Thermal-Vacuum Test Chambers	Frank J. Benz
NASA White Sands Test Facilities	NASA White Sands Test Facility
Las Cruces, NM 88004	P. O. Drawer MM
	Las Cruces, NM 88004
	Phone: (505) 524-5722 FAX: (505) 524-5260

Description:

Thermal vacuum test chambers are currently available to perform material evaluation in vacuum environments. These facilities include the following chambers:

#1	#2	#3
Diameter: 1.8 meters	1.7 meters	0.48 meters
Length: 1.8 meters	3.0 meters	0.61 meters
Pressure: 10-8 Torr to ambient	10-3 Torr to 2 ATM	10-7 Torr to ambient
Temp.: -140 to 107°C	Ambient to 90°C	10 to 150°C

Potential Use(s):

SEI issues associated with environmental interactions of materials and components in space are anticipated for future evaluations in these facilities.

Keywords: Thermal Vacuum chamber, space environmental interactions

Required Modifications/Additions:

Modifications required to implement various environmental interactions are possible based on specific project requirements.

Status: Operational

Year Last Operated: 1991

Estimated Year Available: 1992

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Frank J. Benz
Phone: (505) 524-5722

Date Prepared: 2/06/1992
FAX: (505) 524-5260

Hazardous Hypervelocity Impact Test Facility
NASA White Sands Test Facility
Las Cruces, NM 88004

Frank J. Benz
NASA White Sands Test Facility
P. O. Drawer MM
Las Cruces, NM 88004
Phone: (505) 524-5722 FAX: (505) 524-5260

Description:

The facility currently has 4.3-mm and 7.6mm tow-stage light gas launchers active & available for impacting inert to moderately reactive targets with projectiles traveling at velocities up to 8 km/sec. A 25.4mm system is being assembled & will be active by the beginning of 1992. When the facility is complete, various target containment vessels will be available capable of safely containing detonations equivalent to 2.2 kg of TNT. Also a shaped-charge particle launching system is planned for the near future. Extensive instrumentation is in place & available.

Potential Use(s):

Testing of space vehicles or systems which will be exposed to space debris and micrometeoroid impact, particularly those containing hazardous/reactive fluids or pressurized vessels; debris shield development; and testing of new components and coatings for survivability after hypervelocity impact.

Keywords: Space debris, survivability, space environment, reactive targets, hazardous fluids, debris shield, hypervelocity impact.

Required Modifications/Additions:

The 4.3-mm (0.17-caliber) and 7.6-mm(0.03-caliber) two-stage light gas launchers are currently available for testing inert and hazardous/reactive targets. In 1992, the 25.4-mm (1-inch) launcher will be available. Modifications can be made to the target chambers to accommodate specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1992

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Frank J. Benz
Phone: (505) 524-5722

Date Prepared: 2/06/1992
FAX: (505) 524-5260

Materials & Components Test Cells
Laboratories Test Department
NASA White Sands Test Facility
Las Cruces, NM 88004

Frank J. Benz
White Sands Test Facility
P. O. Drawer MM
Las Cruces, NM 88004
Phone: (505) 524-5722 FAX: (505) 524-5260

Description:

Material and component testing is performed at WSTF in test cells designed for testing under hazardous conditions. Large test chambers (56,000 liters) exist for testing of payloads in vacuum or gaseous oxygen. Hyperbaric test chambers are also available for flammability testing at high pressure (10 ATM). Fourteen of the test cells are capable of withstanding explosions and operation with toxic fluids. Remote test cells for high pressure oxygen are available, as well as facility capability to implement testing with specialty fluids up to 60 MPa.

Potential Use(s):

These facilities are currently used to conduct materials testing in environments that support combustion and can be modified to test materials and components in other aerospace fluids including hydrogen in the future. Other testing issues associated SEI with such as ascent and descent vehicles can be tested at WSTF.

Keywords: Materials compatibility, combustion testing, aerospace fluids, hydrogen compatibility, oxygen compatibility

Required Modifications/Additions:

The WSTF test cells are currently available for test activities. Modifications can be made to accommodate specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Frank J. Benz
Phone: (505) 524-5722

Date Prepared: 2/05/1992
FAX: (505) 524-5260

Gaseous Oxygen High Flow Test Facility

NASA White Sands Test Facility
Las Cruces, NM 88004

Frank J. Benz

White Sands Test Facility (WSTF)

P. O. Drawer MM

Las Cruces, NM 88004

Phone: (505) 524-5722 FAX: (505) 524-5260

Description:

The WSTF gaseous oxygen high flow test facility is designed for testing materials and components in oxygen or nitrogen requiring high pressure (up to 69 MPa), high temperature (up to 810 K), and high flow rate (up to 2.4 cubic meters per second).

Potential Use(s):

This facility has been used to study particle impact ignition of components and materials exposed to flowing high pressure and high temperature oxygen. SEI testing of ascent and descent vehicle components including turbine pumps are likely candidates.

Keywords: High Pressure oxygen, high temperature oxygen, high flow rate oxygen, chemical engine components

Required Modifications/Additions:

The facility is currently available for test activities. Modifications can be made to accomodate specific test requirements.

Status: Operational

Year Last Operated: 1991

Estimated Year Available: 1992

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Frank J. Benz
Phone: (505) 524-5722

Date Prepared: 2/05/1992
FAX: (505) 524-5260

Nondestructive Laboratory Facilities

NASA White Sands Test Facility
Las Cruces, NM 88004

Frank J. Benz

White Sands Test Facility

P. O. Drawer MM

Las Cruces, NM 88004

Phone: (505) 524-5722 FAX: (505) 524-5260

Description:

Nondestructive laboratory test facilities are presently available at WSTF including: X-Ray Radiography (320 kV Source with Film & Real Time), Flash X-Ray (150 & 450 kV Sources), Infrared Thermography, Magnetic Particle, Dye Penetrant, Optical Electronic Speckle Pattern Interferometry, Ultrasonic Imaging (1-50 MHz) Acoustic Emission Spectroscopy, and Neutron Activation Analysis.

Potential Use(s):

Anticipated applications for nondestructive evaluation facilities include the inspection of materials and components used for shuttle testing, Space Station Freedom testing, and future SEI testing.

Keywords: Nondestructive evaluation testing, X-Ray, ultrasonics, holography, dye penetrant, magnetic particle, IR thermography, acoustic emission

Required Modifications/Additions:

Future modifications or additions will depend on specific project requirements.

Status: Operational

Year Last Operated: 1991

Estimated Year Available: 1992

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Frank J. Benz
Phone: (505) 524-5722

Date Prepared: 2/06/1992
FAX: (505) 524-5260

High Energy Enthalpy Facility (HEEF)

NASA-Ames Research Center
Moffett Field, CA 94035

Marc Murbach

M/S 244-10

NASA-Ames Research Center
Moffett Field, CA 94035

Phone: (415) 604-3155 FAX: (415) 604-6997

Description:

Constrictor-type ARCJET facility capable of producing hot H₂ to temperatures and pressures of interest for testing nuclear propulsion materials and subassemblies. Level of contamination of flow is < 10ppm and relatively cleaner than other similarly sized hot hydrogen sources.

Potential Use(s):

As a hot hydrogen test facility

Keywords: Hot hydrogen testing, core elements, materials development, nozzle concepts, nuclear thermal propulsion.

Required Modifications/Additions:

Details of required modifications are currently being examined.

Status: STANDBY

Year Last Operated: 1986

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Marc Murbach
Phone: (415) 604-3155

Date Prepared: 6/18/1991
FAX: (415) 604-6997

Hydrogen Environment Materials
Testing Laboratory
NASA - Ames Research Center
Moffett Field, CA 94035

Howard Nelson
NASA - Ames Research Center
MS 213-3
Moffett Field, CA 94035
Phone: (415) 604-6700 FAX: (415) 604-4984

Description:

Capable of conducting tensile, low cycle fatigue, high cycle fatigue, and crack growth tests on material samples in a hydrogen environment (insitu) at room temperature under pressures up to 1500 psi. Also capable of conducting fracture toughness and permeation tests at temperatures up to 1800°F at 300 psi or up to 2000°F (isothermal or ramping) at 150 psi.

Potential Use(s):

Materials testing in support of the SEI nuclear propulsion project

Keywords: Hydrogen environment materials testing

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: Operational

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 8/06/1991
FAX: (216) 826-6613

Nuclear Rocket Reactor Test
Facility (Test Cell "A")
Nuclear Rocket Development Station(NRDS)
Jackass Flats, NV

Allen Roberts
DOE/NVVO
2753 South Highland
Las Vegas, NV 89109
Phone: (702) 295-0967 FAX: (702) 295-0688

Description:

Test Cell "A" is designed for testing nuclear rocket reactors up to a design thermal power of 1000 MW. The reactors are mounted on a rail car and fired upward. LH2 is used to cool the reactor and the resulting hot gaseous hydrogen is exhausted through a converging - diverging nozzle. The LH2 is delivered to the reactor by a turbopump which is capable of delivering about 75#/sec LH2. The turbopump is driven by high pressure GH2.

Potential Use(s):

Nuclear rocket reactor testing

Keywords: Nuclear rocket reactor testing

Required Modifications/Additions:

The facility was deactivated in 1966 and most of the facility equipment including pumps and storage tanks have since been loaned to other facilities. Major renovations and modifications would be required to reactivate the facility and to meet current environmental safety requirements.

Status: DEACTIVATED

Year Last Operated: 1966

Estimated Year Available: 1997

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 8/15/1991
FAX: (216) 826-6613

Nuclear Rocket Reactor Test
Facility (Test Cell "C")
Nuclear Rocket Development Station(NRDS)
Jackass Flats, NV

Allen Roberts
DOE/NVVO
2753 South Highland
Las Vegas, NV 89109
Phone:(702)295-0967 FAX:(702)295-0688

Description:

Test Cell "C" is designed for testing nuclear rocket reactors up to a design thermal power of 10,000 MW. The reactors are mounted on a rail car and fired upward. LH2 is used to cool the reactor. The resulting hot gaseous hydrogen is exhausted through a converging - diverging nozzle. The LH2 is delivered to the reactor by two paralld turbopumps with a combined pumping capacity of about 350 #/sec. The pumps are driven by high pressure GH2.

Potential Use(s):

Nuclear reactor rocket testing

Keywords:Nuclear reactor rocket testing

Required Modifications/Additions:

The facility was deactivated in 1972 and most of the facility equipment including pumps and storage tanks have since been loaned to other facilities. Major renovations and modifications would be required to reactivate the facility and to meet current environmental safety requirements.

Status: DEACTIVATED

Year Last Operated: 1972

Estimated Year Available: 1997

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216)826-6687

Date Prepared: 8/15/1991
FAX: (216)826-6613

Nuclear Rocket Engine Test
Facility (Test Stand No. 1)
Nuclear Rocket Development Station(NRDS)
Jackass Flats, NV 89109

Allen Roberts
DOE/NVVOO
2753 South Highland
Las Vegas, NV 89109
Phone: (702) 295-0967 FAX: (702) 295-0688

Description:

The ETS-1 is designed for ground testing NERVA type 75,000 # thrust engines in a flight simulated environment. The test stand consists of an aluminum structure supporting a 77000 gal LH2 run tank; an engine compartment radiation shield; a diffuser/ejector exhaust duct with a 2 1/2 million gallon exhaust duct cooling water system; a remote control building; and a cryogenic dewar and high pressure gas vessel tank farm for LN2, GH2, LH2, LO2, GHe, and Propane storage.

Potential Use(s):

Ground testing nuclear thermal rocket engines

Keywords: Nuclear thermal rocket engine testing

Required Modifications/Additions:

The facility was deactivated in 1972 and since that time most of the facility equipment including the crogenic dewars and pressure vessels have been loaned to others. Major renovations and modifications would be required to reactivate the facility and to meet current environmental safety requirements

Status: DEACTIVATED

Year Last Operated: 1972

Estimated Year Available: 1997

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 8/15/1991
FAX: (216) 826-6613

Engine Maintenance, Assembly, and
Disassembly Facility (E-MAD)
Nuclear Rocket Development Station(NRDS)
Jackass Flats, NV 89109

Allen Roberts
DOE/NVOO
2753 South Highland
Las Vegas, NM 89109
Phone: (702) 295-0967 FAX: (702) 295-0681

Description:

The E-MAD facility is designed for the assembly and preparation of NERVA type nuclear rocket engines for testing; refurbishment of radioactively hot engines for additional testing; and disassembly and post mortem inspection of tested engines and components. Transportation between the facility and NRDS test sites is accomplished with a railroad locomotive and heavily shielded rail cars. Hot areas of the facility are shielded by concrete walls and serviced by remote manipulators.

Potential Use(s):

Assembly, refurbishment, disassembly, and post test inspection of nuclear thermal rocket engines and components.

Keywords: Nuclear rocket engine testing and inspection

Required Modifications/Additions:

The facility is operational but presently committed indefinitely to providing radioactive materials handling support for the DOE Radioactive Waste Management and Disposal Program

Status: Operational

Year Last Operated: 1990

Estimated Year Available: Unknown

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 8/15/1991
FAX: (216) 826-6613

Space Power Advanced
Components Engineering Facility
Energy Technology Engineering Ctr (ETEC)
Canoga Park, CA 91304

Fred Poucher
P. O. Box 1449
Canoga Park, CA 91304
Phone: (818) 586-5948 FAX: (818) 586-5118

Description:

Three large and four small high vacuum vessels, including a dedicated 1,000 KVa electrical supply; a 10 MWt liquid metal heat rejection system; a 1000 channel data acquisition system; a Metallurgical and Chemistry Laboratory; and an Instrumentation Laboratory.

Potential Use(s):

Space environment testing of MPD and ION thrusters that use alkalai metal propellants. Space environment testing of space power thermal management components such as radiators, EM pumps, heat pipes, heat exchangers, volume compensators, and sensors.

Keywords: Space environment testing, thrusters, thermal management.

Required Modifications/Additions:

(1992-1995) Modify cooling system to test up to 10 KWe thrusters.

(1996-2003) Upgrade system capacity to test up to 1 MWe thrusters.

Status: STANDBY

Year Last Operated: 1990

Estimated Year Available: 1993

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Bruce Gillies
Phone: (818) 586-5301

Date Prepared: 7/31/1991
FAX: (818) 586-5118

Hydrogen Environment Materials
Testing Laboratory
Naval Weapons Center
China Lake, CA 93555-6001

Commander Attention:
Josephine Covino
Naval Weapons Center Code 3891
China Lake, CA 93555-6001
Phone: (619) 939-3381 FAX: (619) 939-2597

Description:

Capable of conducting permeation tests on material samples in a hydrogen environment (insitu) at temperatures from ambient to 570°F and at pressures up to 15 psi.

Potential Use(s):

Materials testing in support of the SEI nuclear propulsion project.

Keywords: Hydrogen environment materials testing

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: Operational

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 8/06/1991
FAX: (216) 826-6613

Plasma Irradiation Facility (PIF)
Innovative Nuclear Space Power&Prop Inst
Bldg 554, University of Florida
Gainesville,, FL 32608

Drs. N.J. Diaz/E.T. Dugan
INSPI/College of Engineering
University of Florida
Gainesville, FL 32611
Phone:(904)392-1427 FAX: N/A

Description:

KAMAN A-711 14 MeV Neutron Generator with fast neutron flux capabilities of about 10-10 n/cm2 sec. and thermal flux capabilities to 10-8 neutrons/cm2 sec. Modular shielding design with paraffin blocks cast to user specifications provides flexibility in accommodating geometry of target. Nuclear instrumentation and DAC system available. Electrical power, gas handling and routine laboratory instrumentation also available.

Potential Use(s):

Neutron irradiation and fissioning gas experiments. Radiation damage studies, materials, IC's, instrumentation and diagnostic equipment. Nuclear data and shielding studies.

Keywords: Neutron irradiation, radiation damage, nuclear experiments, fissioning plasma

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Isaac Maya
Phone: (904)392-1427

Date Prepared: 3/04/1991
FAX: (904)392-8656

UFTR/Hot Cell
University of Florida Training Reactor
(UFTR) Building
Gainesville, FL 32611

Dr. Nils J. Diaz
INSPI/College of Engineering
University of Florida
Gainesville, FL 32611
Phone: (904) 392-1427 FAX: (904) 392-8656

Description:

A 100 kw thermal, graphite moderated, water-cooled reactor with multiple access ports, including a 2" thru-port for optical diagnostics, large volume experimental tank and low volume rabbit system. A hot cell with remote manipulators is located in the Radiochemistry Lab By the UFTR.

Potential Use(s):

Irradiation of fissile and non-fissile fluids at high temperatures.
Nuclear-pumped lasers

Keywords: Reactor, Hot Cell, Irradiations

Required Modifications/Additions:

Build hi-temperature flux trap

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Dr. Nils J. Diaz
Phone: (904) 392-1427

Date Prepared: 3/04/1991
FAX: (904) 392-8656

Uranium Arc Facility (UAX)
Innovative Nuclear Space Pwr & Prop Inst
Bldg 554 University of Florida
Gainesville, FL 32608

Dr. Isaac Maya
INSPI/College of Engineering
University of Florida
Gainesville, FL 32611
Phone: (904) 392-1427 FAX: (904) 392-8656

Description:

The UAX consists of twin 70 cm OD by 1.5 meter height stainless steel tanks capable of a few atmospheres pressure. In one tank, a tungsten crucible serves as the anode in an electrical arc. The crucible can be loaded with uranium metal or other compounds to be studied at high temperature with or without neutrons. Gas feed can be used for vortex stabilized arc formation. Quartz view ports provide direct spectroscopic access to arc and downstream conditions. Electrical power, gas handling pumps, instrumentation and DAC system are available.

Potential Use(s):

Uranium metal arc facility for investigating energy and mass transfer mechanisms from fuel to working fluid/propellants at temperatures from room temperature to above 10,000K, and pressures from the torr range to 3 atm. Radiation transfer to seeded gases.

Keywords: Uranium arc, arc facility, radiation and mass transfer, irradiation experiments, high temperature, fissioning plasmas

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Dr. Isaac Maya
Phone: (904) 392-1427

Date Prepared: 3/04/1991
FAX: (904) 392-8656

Nuclear MHD Facility (NMX)
Innovative Nuclear Space Pwr & Prop Inst
Bldg 554, University of Florida
Gainesville, FL 32608

Dr. Isaac Maya
INSPI/College of Engineering
University of Florida
Gainesville, FL 32611
Phone: (904)392-1427 FAX: (904)392-8656

Description:

Vortex-stabilized arc device consisting of 2 sections: A high temperature arc zone (greater than 8,000K) and a lower temperature test section (1,000 -3,000K). Quartz view ports provide direct spectroscopic access to both zones. Test section has electrodes and external circuitry for conductivity measurements, and 0.1 T magnetic field capability (lab scale MHD test). Neutron irradiation possible. Remote control operation is available, including UV sensitive fiber optic cable for spectroscopic analysis of optical radiation emission.

Potential Use(s):

Create, control, diagnose, and analyze plasma of nuclear fuel and working fluid/propellants, including UF-4, KF, LiF, gases, etc. at temperatures above 2,500K, in and out of a nuclear environment with and without a magnetic field. Measure optical radiation emission of plasmas, electrical conductivity of ionized gases, MHD power generation, fission enhanced ionization and dissociation.

Keywords: vortex stabilized arc, uranium arc, fissioning plasma, magnetohydrodynamics (MHD), electrical conductivity

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Dr. Isaac Maya
Phone: (904)392-1427

Date Prepared: 3/04/1991
FAX: (904)392-8656

Ultrahigh Temperature Material Test Unit
Innovative Nuclear Space Pwr & Prop Inst
Bldg 554 University of Florida
Gainesville, FL 32608

Dr. Samim Anghaie
INSPI/College of Engineering
University of Florida
Gainesville, FL 32611
Phone: (904) 392-1427 FAX: (904) 392-8656

Description:

The test unit includes an ultrahigh vacuum test section which allows for exposure testing of materials at temperatures between 700K and 3,500K. Low and high frequency RF heating is used and the temperature is accurately controlled by a system of optical micropyrrometer.

Potential Use(s):

Materials compatibility testing in uranium and uranium compounds environment.

Keywords: Materials, Utrahigh Temperature, Uranium, RF heating

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Dr. Samim Anghaie
Phone: (904) 392-1427

Date Prepared: 3/04/1991
FAX: (904) 392-8656

Ultrahigh Temp Nozzle Test Facility
Innovative Nuclear Space Pwr & Prop Inst
Bldg 554 University of Florida
Gainesville, FL 32608

Dr. Samim Anghaie
INSPI/College of Engineering
University of Florida
Gainesville, FL 32611
Phone: (904) 392-1427 FAX: (904) 392-8656

Description:

The facility is built around an interchangeable nozzle test section and a large volume vacuum tank. The gas is either heated by a jet arc to temperatures up to 3,000K or by an inductive plasma torch to temperatures up to 20,000K. The facility is equipped with a full range of flow, pressure and temperature measurement instruments.

Potential Use(s):

Measurement of thermophysical properties of propellant gases at high temperatures and nozzle materials performance testing.

Keywords: Nozzle, Ultrahigh Temperature, Propulsion

Required Modifications/Additions:

Full integration of the inductive plasma torch for testing at temperatures above 3,000K.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Dr. Samim Anghaie
Phone: (904) 392-1427

Date Prepared: 3/04/1991
FAX: (904) 392-8656

MIT Research Reactor (MITR-II)

Massachusetts Institute of Technology
Cambridge, MA 02139

John A. Bernard

Massachusetts Institute of Technology
138 Albany St. NW12-210
Cambridge, MA 02139
Phone: (617) 253-4202 FAX: (617) 253-7300

Description:

5 MWt Research Reactor that is light-water cooled and heavy-water reflected. Thermal neutron flux of $5-10 \times 10^{13}$ n/cm²/s; fast neutron flux of 1×10^{14} n/cm²/s. Includes blanket test facility and several fission spectrum facilities. Two fully-equipped hot cells are available as well as state-of-the-art equipment for neutron activation analysis. Facility operates 100 plus hours per week at 4.9 MW. Experimental facilities include in-core loops for high pressure/high temperature materials studies. Equipped with state-of-the-art digital control system.

Potential Use(s):

Materials studies including (1) effect of neutron and gamma radiation on electronic components, (2) combined effects of temperature, radiation, Stress (including cyclic) on metal specimens, (3) analysis of atomic and molecular structure. Also, studies on the closed-loop digital control of reactors including design and evaluation of control methods for spacecraft reactors.

Keywords: Materials testing; digital control; nuclear thermal

Required Modifications/Additions:

Reactor and experimental facilities listed above are fully operational. Modifications to tailor flux/temperatures for a particular experiment may be required. Space radiation environments could be created in the blanket test facility (6'x6'x4).

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: John A. Bernard
Phone: (617) 253-4202

Date Prepared: 2/14/1991
FAX: (617) 253-7300

Hydrogen Environment Materials
Testing Laboratory (Packard Lab #19)
Lehigh University
Bethlehem, PA 18015

Robert P. Wei
Lehigh University
M.E. Dept - Rm 356
Bethlehem, PA 18015
Phone: (215) 758-5532 FAX: (215) 758-3079

Description:

Capable of conducting tensile, high cycle fatigue, crack growth, and fracture toughness tests on material samples in a hydrogen environment at temperatures from -31 to 300°F under pressures up to 15 psi and up to 1650°F at pressures up to 50 psi.

Potential Use(s):

Materials testing in support of the SEI nuclear propulsion project.

Keywords: Hydrogen environment materials testing.

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 8/08/1991
FAX: (216) 826-6613

UNC Manufacturing Technology, Inc.

67 Sandy Desert Rd.
Uncasville, CT 06382

Harold M. Burton

67 Sandy Desert Rd.
Uncasville, CT 06382
Phone: (203)848-1511 FAX: (203)848-0022

Description:

UNC's facility located in Uncasville CT is a complete manufacturing plant for the production of nuclear fuel. The facility is NRC licensed (SNM-368) for high enriched uranium. UNC's manufacturing capabilities include machining, GTA and EB welding, custom fabrication, and clean room assembly. Inspection capabilities include manual and computerized (CMM) dimensional inspection, nondestructive testing (X-Ray, liquid penetrant, fluorescent penetrant, ultrasonic test and magnetic particle inspection) as well as specialized facilities for inspection of nuclear fuel.

Potential Use(s):

In addition to being an excellent site for the manufacture of reactor fuel and other components, portions of the facility can be easily segregated and adapted for use as research laboratories and prototype shops for fabrication of test specimens to be used in furthering the design of space nuclear power systems and subsystems.

Keywords: Fuel, manufacture, inspect, design, prototype, SNM license, Security.

Required Modifications/Additions:

Facilities for general manufacturing and inspection of nuclear fuel are pre-existing. Only incremental costs, which are a function of specific mission requirements, would be incurred to utilize this resource.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: J. A. Zarkin
Phone: (203)848-1511

Date Prepared: 2/04/1991
FAX: (203)848-0022

Nuclear Fuel Services, Inc.

1205 Banner Hill Road
Erwin, TN 37650

James A. Long

1205 Banner Hill Road
Erwin, TN 37650
Phone: (615) 743-9141 FAX: (615) 743-2315

Description:

Manufacturer of specialty nuclear fuels. DOE prime contractor and supplier of highly enriched nuclear fuel materials for the U.S. Naval Reactors Program. Contractor for the DOE New Production Reactor Target Manufacturing Facility. Includes design, construction, and operation (NRC Class I secure facility). Over thirty (30) years experience in nuclear materials processing of uranium metal, thorium metal, MOX (uranium/plutonium) fuel, commercial UO₂ fuel, irradiated fuel recovery.

Potential Use(s):

Uranium oxide/uranium carbide fuels development and manufacture. Reactor materials development. Isotope fuel development and manufacture.

Keywords: Nuclear fuel development and manufacture

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: James A. Long
Phone: (615) 743-1764

Date Prepared: 7/18/1991
FAX: (615) 743-2315

Space Reactor Assembly
Naval Nuclear Fuel Division
Babcock and Wilcox
Lynchburg, VA 24505

Paul Ayres
Babcock and Wilcox
P. O. Box 785
Lynchburg, VA 24505
Phone: (804) 522-5533 FAX: (804) 522-5922

Description:

The Naval Nuclear Fuel Division has facilities for fabrication of reactor components and assembly of fuel elements into complete reactors containing highly enriched uranium, beryllium, and other controlled materials. The plant has approximately 700,000 square feet of environmentally controlled and secured buildings within 39 acres of perimeter fencing. The facility has extensive inspection and quality assurance/characterization facilities and is managed to NQA-1 requirements.

Potential Use(s):

Fabrication, inspection, and shipment of complete space reactor assemblies.

Keywords: Fuel fabrication; reactor assembly

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: LICENSED

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: J. D. Malloy
Phone: (804) 522-6388

Date Prepared: 8/01/1991
FAX: (804) 522-6762

Compact Reactor Fuel Facility
Naval Nuclear Fuel Division
Babcock and Wilcox
Lynchburg, VA 24505

Paul Ayres
Babcock and Wilcox
P. O. Box 785
Lynchburg, VA 24505
Phone: (804) 522-5533 FAX: (804) 522-5922

Description:

The Compact Reactor Fuel Facility (CRFF) is a chemical process line for converting high enriched uranium into uranium oxide, uranium carbide, uranium oxycarbide, and mixed carbide microspheres. The facility can coat microspheres with low or high density carbon and/or other carbide coatings.

Potential Use(s):

Manufacture of high temperature oxide and carbide fuels for NEP & NTP applications, including coating particles for PBR's and beaded NERVA fuel. With modifications (U,Zr) C composite and all carbide fuel elements can be fabricated.

Keywords: Fuel Fabrication

Required Modifications/Additions:

Modification requirements depend on feed stock and fuel specification.

Status: LICENSED

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: J. D. Malloy
Phone: (804) 522-6388

Date Prepared: 8/01/1991
FAX: (804) 522-6762

Chemical Vapor Deposition (CVD)
Naval Nuclear Fuel Division
Babcock and Wilcox
Lynchburg, VA 24505

Paul Ayres
Babcock and Wilcox
P. O. Box 785
Lynchburg, VA 24505
Phone: (804) 522-5533 FAX: (804) 522-5922

Description:

NNFD CVD facilities manufacture and coat various high temperature reactor fuels. UCx, UO2, and (U:Zr) materials are provided with multiple layer coatings of pyrocarbon and carbide materials to the thickness, density, crush strength, stoichiometry or other specifications as required. The facility can also supply outer coatings for structural integrity for high or medium temperature applications.

Potential Use(s):

Coatings for various space reactor fuels.

Keywords: CVD Fuel Fabrication, Advanced Materials Development

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: LICENSED

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: J. D. Malloy
Phone: (804) 533-6388

Date Prepared: 8/01/1991
FAX: (804) 522-6762

Fuel Characterization Facility
Lynchburg Research Center
Babcock and Wilcox
Lynchburg, VA 24506-1165

David L. Baty
Babcock and Wilcox
P. O. Box 11165
Lynchburg, VA 24506-1165
Phone: (804) 522-5472 FAX: (804) 522-6762

Description:

Non-irradiated high enriched fuels can be examined using optical microscopes, X-ray diffraction, SEM, chemical analysis, and TGA/DTA. Environment testing can be performed in a vacuum or in static gas (H₂) environments up to 3000 C. Melt point studies, cryogenic cyclic testing, elevated temperature cyclic testing, materials interaction, CVD coatings, and mechanical testing can be performed on fuel materials. Examination of irradiated fuels can be performed in the Hot Cell Facility.

Potential Use(s):

Development of space reactor fuel and manufacturing processes for those fuels

Keywords: Fuel Fabrication, Advanced Material Development, Materials Testing

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. Malloy
Phone: (804) 522-5472

Date Prepared: 8/01/1991
FAX: (804) 522-6762

Hot Isostatic Press (HIP) Facility
Naval Nuclear Fuel Division
Babcock and Wilcox
Lynchburg, VA 24505

Paul Ayres
Babcock and Wilcox
P. O. Box 785
Lynchburg, VA 24505
Phone: (804) 522-5533 FAX: (804) 522-5922

Description:

The Hot Isostatic Press Facility is capable of bonding large high enriched uranium/clad structures at 2000 psia & 2000F.

Potential Use(s):

Fabrication of pin type elements or NERVA type elements for high temperature space reactors. This approach is potentially superior to extrusion of carbon based prismatic fuel elements.

Keywords: Fuel Fabrication

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: LICENSED

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: J. D. Malloy
Phone: (804) 522-6388

Date Prepared: 8/01/1991
FAX: (804) 522-6762

Hot Cell Facility
Lynchburg Research Center
Babcock and Wilcox
Lynchburg, VA 24506

David L. Baty
Babcock and Wilcox
P. O. Box 11165
Lynchburg, VA 24506
Phone: (804) 522-5472 FAX: (804) 522-6762

Description:

B&W maintains four independent beta, gamma type hot-cell facilities for examination of irradiated materials and fuels. The four cell complex includes a large multi-purpose cell, a metallography cell, and two mechanical testing cells. Entrance into the hot cell is by a high bay with a 25 ton crane for cask handling. All cells are interconnected by transfer ports.

Potential Use(s):

Post irradiation examination of space reactor fuels and components.

Keywords: Post irradiation examination, fuel element testing

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. Malloy
Phone: (804) 522-6388

Date Prépared: 8/01/1991
FAX: (804) 522-6762

Refractory Metal Fabrication
Naval Nuclear Fuel Division
Babcock and Wilcox
Lynchburg, VA 24506

Payl Ayres
Babcock and Wilcox
P. O. Box 785
Lynchburg, VA 24505
Phone: (804) 522-5533 FAX: (804) 522-5922

Description:

The Naval Nuclear Fuel Division has inhouse capability to machine and weld refractory metal components to high tolerances.

Potential Use(s):

Refractory metal components may be required for fuel element cladding, for internal reactor structures, and for reactor vessels and piping.

Keywords: Fuel fabrication

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: LICENSED

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. Malloy
Phone: (804) 522-6388

Date Prepared: 8/01/1991
FAX: (804) 522-6762

High Quality and Precision Components
Naval Nuclear Fuel Division (NNFD)
Babcock and Wilcox
Lynchburg, VA 24505

Paul Ayres
Babcock and Wilcox
P. O. Box 785
Lynchburg, VA 24505
Phone: (804) 522-5533 FAX: (804) 522-5922

Description:

NNFD specializes in high precision manufacturing, producing both large and small components and assemblies to "watch maker" tolerances. Metals include Zircaloy, Hafnium, Niobium, stainless steel and other alloys including radioactive materials. NNFD has traditionally built products that must operate without failure in the most demanding environments.

Potential Use(s):

Machining/Fabrication of space reactor parts and components.

Keywords: Fuel Fabrication

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: LICENSED

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: John Malloy
Phone: (804) 522-6388

Date Prepared: 8/01/1991
FAX: (804) 522-6762

EB Welding Service
Naval Nuclear Fuel Division
Babcock and Wilcox
Lynchburg, VA 24505

Paul Ayres
Babcock and Wilcox
P. O. Box 785
Lynchburg, VA 24505
Phone: (804) 522-5533 FAX: (804) 522-5922

Description:

B&W has extensive welding experience with zirconium and hafnium which include gas tungsten arc, gas metal arc, plasma, electron beam, and laser. NNFD has more than 30 controlled atmosphere/vacuum chambers for welding which have computerized process parameter controls. NNFD does lab welding of G-4 Titanium and explosive welding of SiC/6061 Al metal matrix composites (UMC).

Potential Use(s):

Varied uses for space reactor components

Keywords: Fuel Fabrication

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: J. D. Malloy
Phone: (804) 522-6388

Date Prepared: 8/01/1991
FAX: (804) 522-6762

Advanced Materials Development
Lynchburg Research Center
Babcock and Wilcox
Lynchburg, VA 24506-1165

David L. Baty
Babcock and Wilcox
P. O. Box 11165
Lynchburg, VA 24506-1165
Phone: (804) 522-5472 FAX: (804) 522-6762

Description:

Ceramic composite, metal matrix composite, and refractory/reactive metals development performed for nuclear & non-nuclear materials. The facility is involved in CVD coatings, CVI structures, filament winding, sol-gel impregnation, cold press/sintering, cold isostatic press/sintering, hot isostatic pressing & hot pressing. Materials can be examined using optical microscopes, X-ray diffraction, SEM, Acoustic emission, chemical analysis, TGA/DTA. Environment & computer controlled mechanical testing can be performed in a vacuum or in static gas (H₂) environment up to 3000 C.

Potential Use(s):

Development of high temperature materials for NTP & NEP systems.

Keywords: Advanced material development, materials testing

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: LICENSED

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: J. D. Malloy
Phone: (804) 522-6388

Date Prepared: 8/01/1991
FAX: (804) 522-6762

Cold Flow Test Facility
Alliance Research Center
Babcock and Wilcox
Alliance, OH 44601-2196

Jerry Ackerman
Babcock and Wilcox/Alliance Research
1562 Beeson Street
Alliance, OH 44601-2196
Phone: (216) 823-7403 FAX: (216) 823-0639

Description:

Cold flow facilities are available for single and two-phase fluids including H₂. Variations in flow velocity can be measured using laser doppler scanning to provide 3-D flow profile.

Potential Use(s):

Space reactor fuel element design.

Keywords: Cold Flow Testing

Required Modifications/Additions:

Test loop may require minor modification depending on specimen size, flow velocity or other test parameters.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. Malloy
Phone: (804) 522-6388

Date Prepared: 8/01/1991
FAX: (804) 522-6762

Hydrogen Environment Materials
Testing Laboratory
Babcock and Wilcox
Alliance, OH 44601

Larry D. Paul
Babcock and Wilcox
1562 Beeson Street
Alliance, OH 44601
Phone: (216) 821-9110 FAX: (216) 829-7832

Description:

Capable of conducting tensile, creep rupture, low cycle fatigue, high cycle fatigue, crack growth, and fracture toughness tests on material samples in a hydrogen environment (precharged or insitu) at temperatures up to 750°F and at pressures up to 5300 psi. Can also conduct permeation and absorption tests at 750°F and 5300 psi. Additional capability to conduct creep tests at 1800°F is presently planned for the future.

Potential Use(s):

Materials testing in support of the SEI nuclear propulsion project

Keywords: Hydrogen environment materials testing

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 8/06/1991
FAX: (216) 826-6613

Rocket Engine Test Facility
(Test Area E)
Aerojet Propulsion Division (Dept 5152)
Sacramento, CA 95813

Wayne Dahl
Aerojet Propulsion Division
Dept 5152
Sacramento, CA 95813
Phone: (916) 355-3956 FAX: (916) 355-2019

Description:

This facility is capable of testing crogenic or hydrocarbon rocket engines and/or components up to 700,000 lb thrust. The site has storage capacity for 1300 cu. ft. of 6800 psi GH2; 40000 gal. LH2 (600 gal at 5500 psi, 10000 gal at 200 psi, and 29400 gal at 150 psi) and LO2, CH4, GN2, GH4, RP-1, LCH4, and GHe. Supporting shops and data systems are in place and operational as are environmental and safety permits. An experienced crew is also on board and active.

Potential Use(s):

With the addition of a hydrogen/oxygen injector as a heat source, all components, sub-systems, and systems of a nuclear rocket engine could be tested prior to integration with the reactor. Also an existing arcjet pebble bed hot hydrogen heater could be used for nozzle testing and testing of other materials or systems requiring hot hydrogen

Keywords: NTP Systems Tests, hot hydrogen testing, nozzle testing

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Wayne Dahl
Phone: (916) 355-3956

Date Prepared: 4/24/1991
FAX: (916) 355-2019

Simulated Altitude Engine & Thrust
Chamber Assembly Test Facility (J-4)
Aerojet Propulsion Division
Sacramento, CA 95813

Paul Hill
Aerojet Propulsion Division
P. O. Box 13222
Sacramento, CA 95813
Phone: (916) 355-4205 FAX: (916) 355-2037

Description:

This facility consists of a steam ejector system used for pulling a vacuum on a 16' X 17' X 8' test cell. This facility has several diffusers, used to maintain a vacuum during test. The facility has the capability of testing a 20K thrust engine for approximately 100 seconds with a start and run altitude of 120,000 feet.

Potential Use(s):

Non-nuclear nozzle and thrust chamber assembly simulated altitude testing.

Required Modifications/Additions:

Add larger LH2 run vessel and activate the existing LO2 run vessel.

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1992

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Paul Hill
Phone: (916) 355-4204

Date Prepared: 7/30/1991
FAX: (916) 355-2037

A-6 Liquid Hydrogen Facility
Aerojet Propulsion Division
A-Zone Bldg. 30-0003
Sacramento, CA 95813

Kent Schaplowsky
P. O. Box 13222
Bldg 30003 / Dept 5364
Sacramento, CA 95813
Phone: (916) 355-2607 FAX: (916) 355-6826

Description:

The A-6 facility is a propulsion system component test stand with a 150 gallon liquid hydrogen run tank capable of operating at pressures up to 5,500 psig. The run tank is supplied by a 2,000 gallon liquid hydrogen storage tank.

Potential Use(s):

Propulsion system component testing.

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Kent Schaplowsky
Phone: (916) 355-2607

Date Prepared: 7/30/1991
FAX: (916) 355-6826

Dynamic Test Facility
Aerojet Propulsion Division
A-Zone Bldg. 30-003
Sacramento, CA 95813

Kent Schaplowsky
P. O. Box 13222
Bldg 30003 / Dept 5364
Sacramento, CA 95813
Phone: (916) 355-2607 FAX: (916) 355-6826

Description:

The dynamic test facility provides the capability to perform vibration, shock, and acceleration testing. Centrifuges, two (2) 7K pound force shakers, and a 15K pound force shaker are available to perform these tests. Both local and remote operation of the test equipment are possible.

Potential Use(s):

System component vibration, shock, and elevated "g" response evaluation.

Required Modifications/Additions:

To be defined based on project test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Kent Schaplowsky
Phone: (916) 355-2607

Date Prepared: 7/30/1991
FAX: (916) 355-6826

Manufacturing and Production Facility Aerojet Electronic System Division Azusa, CA 91702	Linda Means Aerojet Electronic System Division Dept 1431 Azusa, CA 91702 Phone: (818)812-1333 FAX: (818)969-9010																																				
Description: This facility is dedicated to the manufacture of precision weapons, infrared, millimeter wave, electronic circuits, system integration and associated mechanisms. The facility contains a clean room which meets the requirements of MIL-STD 2000 for electronic assembly. The manufacturing area has a built-in matrix distribution system for electrical power, compressed air, data/voice communication, ESD grounding, liquid nitrogen, gaseous nitrogen, vacuum, chilled water and deionized water.																																					
Potential Use(s): Electronic circuit boards for a nuclear rocket engine control system can be manufactured, integrated and tested at this facility. Further environmental/nuclear testing could be accomplished at the AESD Environmental Facility and Air Force Laboratories.																																					
Required Modifications/Additions: To be defined based on specific test requirements.																																					
Status: OPERATIONAL <div style="display: flex; justify-content: space-between;"> Year Last Operated: 1990 Estimated Year Available: 1991 </div>																																					
Estimated Capital Cost: <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 10%;">FY</td> <td style="width: 10%;">92</td> <td style="width: 10%;">93</td> <td style="width: 10%;">94</td> <td style="width: 10%;">95</td> <td style="width: 10%;">96</td> <td style="width: 10%;">97</td> <td style="width: 10%;">98</td> <td style="width: 10%;">99</td> </tr> <tr> <td>\$M</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 10%;">FY</td> <td style="width: 10%;">00</td> <td style="width: 10%;">01</td> <td style="width: 10%;">02</td> <td style="width: 10%;">03</td> <td style="width: 10%;">04</td> <td style="width: 10%;">05</td> <td style="width: 10%;">06</td> <td style="width: 10%;">Total</td> </tr> <tr> <td>\$M</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>		FY	92	93	94	95	96	97	98	99	\$M									FY	00	01	02	03	04	05	06	Total	\$M								
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<div style="display: flex; justify-content: space-between;"> <div> Prepared by: Linda Means Phone: (818)812-1333 </div> <div> Date Prepared: 7/30/1991 FAX: (818)969-9010 </div> </div>																																					

Environmental Test Facility

Aerojet Electronic Systems Division
Azusa, CA 91702

Linda Means

Aerojet Electronic System Division
Dept 1431

Azusa, CA 91702

Phone: (818) 812-1333 FAX: (818) 969-9010

Description:

This facility is equipped with several space simulation chambers varying in size from 14 by 30 inches to 20 by 30 feet with background temperature environments from -320°F to +250°F and operating pressures down to 3×10^{-8} torr. The vibration and shock sections are equipped to test and measure displacements, deflections, reactions, vibrations, resonances, and their intercorrelations over a significant set of frequencies. A particle impact noise detection (PIND) device is used to test extremely small integrated circuits under vibration and shock conditions.

Potential Use(s):

Electronic subsystems and assemblies for the nuclear rocket engine controller can be functionally tested, thermally cycled, and vibration tested at this facility.

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Linda Means
Phone: (818) 812-1333

Date Prepared: 7/30/1991
FAX: (818) 812-9010

Hydrogen Embrittlement Test Facility
Aerojet Propulsion Division
A-Zone Bldg 30-0003
Sacramento, CA 95813

Kent Schaplowsky
P.O.Box 13222
Bldg 30003 / Dept 5364
Sacramento, CA 95813
Phone: (916) 355-2607 FAX: (916) 355-6826

Description:

The hydrogen embrittlement test facility is a materials test facility that permits the investigation of the effects of hydrogen exposure on materials at elevated temperature, elevated pressure, and under various load conditions. The facility consists of two (2) 50K Instron load frames modified to permit tensile, compression, low-cycle fatigue, high-cycle fatigue, and stress rupture testing in hydrogen or helium at pressures up to 5,000 psig and temperatures up to 1,100°F.

Potential Use(s):

Potential uses include providing data concerning the effects of hydrogen exposure on candidate materials of construction.

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Kent Schaplowsky
Phone: (916) 355-2607

Date Prepared: 7/30/1991
FAX: (916) 355-6826

Hydrogen Environment Materials Testing Laboratory Aerojet Propulsion Division Sacramento, CA	Ron Horn Aerojet Propulsion Division MS: 2019 Dept: 5270 Sacramento, CA 95813-6000 Phone: (916) 355-2703 FAX: (916) 355-6543
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Description:

Capable of conducting tensile, creep, stress rupture, low cycle fatigue, high cycle fatigue, crack growth, and fracture toughness tests on material samples in a hydrogen environment at temperatures up to 1400°F and at pressures up to 5000 psi.

Potential Use(s):

Materials testing in support of the SEI nuclear propulsion project.

Keywords: Hydrogen environment materials testing

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 8/06/1991
FAX: (216) 826-6613

Rocket Engine Test Facility
Santa Susana Field Laboratory (SSFL)
Rocketdyne Div. - Rockwell Inc.
Canoga Park, CA 91303

Stan Fischler
Rocketdyne
6633 Canoga Avenue
Canoga Park, CA 91303
Phone: (818) 710-5087 FAX: (818) 710-5753

Description:

Rocketdyne's rocket engine test laboratory (SSFL) includes a complete spectrum of rocket engine test facilities. Components, subsystems & systems up to 600K lb thrust can be accommodated. CTL-V can test hydrogen turbopumps (17,500 hp electric drives; 20,000 hp dynamometers; GH2 to 5000 psi; LH2 tanks up to 45000 gallons; a 1200 gallon 2000 psig LH2 tank & GN2 to 5000 psi). APTF & Coco stands can test subscale & full scale non-nuclear components & systems (GH2 to 14,000 psi; 15,000 gallon LH2 tanks; and GN2, and GHe systems).

Potential Use(s):

Subscale and full scale development of nuclear rocket engine components, turbopumps, subsystems and systems prior to reactor integration. Excludes tests requiring high altitude simulation such as high area ratio nozzle testing.

Keywords: LH2 pump tests, GH2 turbine tests, turbopump tests, non-nuclear components tests, non-nuclear system tests.

Required Modifications/Additions:

As may be required to support specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Tim Harmon
Phone: (818) 718-4744

Date Prepared: 7/30/1991
FAX: (818) 718-4840

Metallurgical Laboratory
Rocketdyne Division - Rockwell Int.
6633 Canoga Avenue
Canoga Park, CA 91303

Tim Harmon
Rocketdyne
6633 Canoga Avenue
Canoga Park, CA 91303
Phone: (818) 718-4744 FAX: (818) 718-4840

Description:

Metallurgical laboratories are equipped for evaluating the physical and mechanical properties of metals and other materials. Capabilities include facilities for performing tensile; impact, creep, low-cycle fatigue, high-cycle fatigue, hardness, dynamic modulus, thermal conductivity and expansion, and stress corrosion tests. Facilities also are available for performing tests in vacuum, hydrogen or inert atmospheres and at temperature extremes from -320 to 5400 F.

Potential Use(s):

Non-nuclear screening and testing of materials for the nuclear rocket engine.

Keywords: Non-nuclear material testing; hydrogen, inert and vacuum environments; non-destructive evaluation; structural testing; low cycle fatigue, and high cycle fatigue testing

Required Modifications/Additions:

As required to meet specific test requirements.

Status: Operational

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Tim Harmon
Phone: (818) 718-4744

Date Prepared: 7/30/1991
FAX: (818) 718-4840

Environmental Effects Laboratory
Rocketdyne - Rockwell International
6633 Canoga Avenue
Canoga Park, CA 91303

Bob Jewett
Rocketdyne - Rockwell International
6633 Canoga Avenue MS: IB-17
Canoga Park, CA 91303
Phone: (818) 718-4473 FAX: (818) 718-4840

Description:

Capable of conducting tensile tests in hydrogen and helium environments at pressures as high as 10000 psi and at temperatures from cryogenic to 1800 F. The laboratory can also conduct low and high cycle fatigue and fracture mechanics tests at similar pressures and temperatures. A unique test apparatus also exists to thermally charge materials in hydrogen at pressures of 5000 psi and temperatures of 1200 F with quench rates of 300 F/min. A thermal fatigue system capable of testing in high pressure hydrogen is also presently being procured.

Potential Use(s):

Materials testing in support of the SEI nuclear propulsion project

Keywords: Hydrogen environment materials testing

Required Modifications/Additions:

To be defined based on specific test requirements

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 8/06/1991
FAX: (216) 826-6613

Hot Hydrogen Gas Generator (HHGG)	Tom Tippetts
GFSD San Tan Remote Test Site	Garrett Fluid System Division
San Tan, AZ	1300 W. Warren Rd. P.O.Box 22200
	Tempe, AZ 85282
	Phone: (602) 893-5784 FAX: (602) 893-4500

Description:

The HHGG provides a continuous flow of hydrogen gas at a temperature of 2750K and a pressure of 1000 psi. The energy source is a hydrogen/oxygen combustor with an internal heat exchanger to heat a separate stream of hydrogen gas.

Potential Use(s):

Nozzle erosion testing, turbopump development, control valve development, high temperature materials compatibility testing, fuel element testing, or other testing requiring a flow of oxygen-free hot hydrogen gas.

Keywords: Hot hydrogen, nozzle development, turbopump development, fuel testing, high temperature materials.

Required Modifications/Additions:

A subscale unit with a flow rate of 0.12 pounds of hydrogen per second is scheduled for completion in first quarter of 1992. A full scale unit is planned for a flow rate of 2.5 to 5.0 pounds per second, with completion in 1993

Status: OPERATIONAL

Year Last Operated: New Facility

Estimated Year Available: 1992

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Tom Tippetts
Phone: (602) 893-5784

Date Prepared: 8/21/1991
FAX: (602) 893-4500

San Tan Hydrogen Test Facility
GFSD San Tan Remote Test Site

San Tan, AZ

Tom Tippetts
Garrett Fluid Systems Division
1300 West Warren Rd P.O.Box 22200
Tempe, AZ 85282
Phone: (602)893-5784 FAX: (602)893-4500

Description:

This remotely located test facility has storage capability for hydrogen, oxygen, helium, argon, nitrogen, and propane. An open test pad to accommodate several simultaneous test set ups is adjacent to the storage tanks, and separated by barrier walls. Test facility meets present DOD explosive site separation distance requirements.

Potential Use(s):

Combustor development propellant management system development, cryogenic valve testing, turbopump testing, hydrogen testing, materials compatibility testing.

Keywords: Hydrogen, test facility, oxygen, remote test, crogenic

Required Modifications/Additions:

Setup for specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1991

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Tom Tippetts
Phone: (602)893-5784

Date Prepared: 8/21/1991
FAX: (602)893-4500

Advanced Materials Laboratory

United Technologies Pratt & Whitney
West Palm Beach, FL 33410

A. R. Cox

United Technologies Pratt & Whitney

West Palm Beach, FL 33410

Phone: (407) 796-6560 FAX: (407) 796-7454

Description:

The Rapid Solidification Rate (RSR) facility includes: a) Rotary atomization/helium quench RSR powder making devices (capacity 9 to 900kg) b) Inert powder handling and classification equipment c) Static and dynamic powder outgassing systems d) Subscale (up to 3kg) extrusion and HIP consolidation presses e) Heat treat, forging, rolling and master alloy melting facilities.

Potential Use(s):

Source for non-nuclear processing and development of advanced alloys and fuel elements.

Required Modifications/Additions:

Addition of large plasma (> 250kw) melting equipment will be required to melt refractory alloy systems.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: R. Metcalfe
Phone: (407) 796-6535

Date Prepared: 5/01/1991
FAX: (407) 796-7454

Space Propulsion Test Facility
Area E
United Technologies Pratt & Whitney
West Palm Beach, FL 33410

R. L. Pase
United Technologies Pratt & Whitney
West Palm Beach, FL 33410
Phone: (407) 796-3897 FAX: (407) 796-1792

Description:

Area E consists of 17 test stands for development on Non-Nuclear Chemical Rocket Components. Facility E-8, High Pressure Cryogenic Test Facility, can test Hydrogen Turbopumps up to 162 lb/sec, Combustion Chambers up to 178 lb/sec at 5000 PSI chamber pressure and thrusts up to 500,000 lb sea level. This facility has Gaseous Hydrogen of 4050 WCF @ 9900 PSI, Gaseous Nitrogen of 755 WCF @ 11000 PSI + 405 WCF @ 9900 PSI, and Gaseous Helium 100 WCF @ 5000 PSI, and 500 KVA/480 volt sub-station.

Potential Use(s):

Heated hydrogen component testing
Turbomachinery component testing
Heated hydrogen for NPSH pump development
Thrust chamber development

Required Modifications/Additions:

To be defined based on test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: L. G. Gillis
Phone: (407) 796-1160

Date Prepared: 5/01/1991
FAX: (407) 796-1792

Materials and Structures Laboratory
United Technologies Pratt & Whitney
West Palm Beach, FL 33410

C. E. Meece, Jr.
United Technologies Pratt & Whitney
West Palm Beach, FL 33410
Phone: (407) 796-5975 FAX: (407) 796-7454

Description:

The M&S Laboratory is used to conduct tests on propulsion system components and materials such as superalloys, powered metals, ceramics, and composites under extreme environmental conditions. Capabilities include tensile, fatigue, creep and fracture mechanics testing at temperatures from -450 to 2500°F. Similar tests can also be performed in high-pressure hydrogen (to 5000 psig) and other environments from ambient temperature to 1800°F. Component structural tests include static, dynamic, and thermal loading of engine hardware.

Potential Use(s):

Non-nuclear screening and testing of candidate materials for air-breathing and rocket propulsion system applications.

Keywords: non-nuclear, advanced materials testing, hydrogen environment testing, component structural testing, NDE

Required Modifications/Additions:

As may be required to meet specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: J. R. Warren
Phone: (407) 796-6512

Date Prepared: 5/01/1991
FAX: (407) 796-7454

Hydrogen Environment Materials
Testing Laboratory
Pratt & Whitney
West Palm Beach, FL

Brad Cowles
Pratt & Whitney
P. O. Box 109600 MS: 707-22
West Palm Beach, FL 33410-9600
Phone: (407) 796-6554 FAX: (407) 796-7454

Description:

Capable of conducting tensile, creep, creep rupture, low cycle fatigue high cycle fatigue, crack growth, and fracture toughness tests on material samples in a hydrogen environment (insitu) at temperatures up to 1600°F and at pressures up to 7500 psi.

Potential Use(s):

Materials testing in support of the SEI nuclear propulsion project.

Keywords: Hydrogen environment materials testing

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: Operational

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 8/06/1991
FAX: (216) 826-6613

Hydrogen Environment Materials Testing Laboratory/505 King Avenue Battelle - Columbus Columbus, OH 43201-2693	Henry Cialone Battelle - Columbus 505 King Avenue Columbus, OH 43201-2693 Phone: (614) 424-4271 FAX: (614) 424-3818
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Description:

Capable of conducting tensile, creep, creep rupture, low cycle fatigue, high cycle fatigue, fracture toughness, and crack-growth tests on samples in a hydrogen environment (insitu) at temperatures up to 500 F and at pressures up to 1000 psi. Precharging, or conducting absorption and permeation tests at temperatures up to 1800 F and at pressures up to 2000 psi.

Potential Use(s):

Materials testing in support of the SEI nuclear propulsion project

Keywords: Hydrogen environment materials testing

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 8/06/1991
FAX: (216) 826-6613

Hydrogen Environment Materials
Testing Laboratory
Cortest Laboratories, Inc.
Cypress, TX 77429

Michael Cayard
Cortest Laboratories, Inc.
11115 Mills Road - Suite 102
Cypress, TX 77429
Phone: (713) 890-7575 FAX: (713) 890-3356

Description:

Capable of conducting tensile, creep rupture, low cycle fatigue, high cycle fatigue, crack growth, and fracture toughness tests on material samples in a hydrogen environment (precharged or insitu) at temperatures ranging from -250 to 1800°F and at pressures up to 5000 psi. Also capable of tensile and crack growth tests up to 600°F at 20,000 psi and tensile, low cycle fatigue, and fracture toughness tests down to -423°F at 15 psi.

Potential Use(s):

Materials testing in support of the SEI nuclear propulsion project.

Keywords: Hydrogen environment materials testing

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: Operational

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 8/06/1991
FAX: (216) 826-6613

Hydrogen Environment Materials
Testing Laboratory
General Dynamics
San Diego, CA

Tom Eisenreich
General Dynamics
P. O. Box 85990 MS: 24-8560
San Diego, CA 92138
Phone: (619) 547-4304 FAX: (619) 974-4000

Description:

Capable of conducting tensile, creep, creep rupture, low cycle fatigue, high cycle fatigue, crack growth, and fracture toughness tests on material samples at liquid hydrogen temperatures and at pressures up to 15 psi.

Potential Use(s):

Materials testing in support of the SEI nuclear propulsion project.

Keywords: Hydrogen environment materials testing

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 6/03/1991
FAX: (216) 826-6613

Hydrogen Environment Materials
Testing Laboratory
IIT Research Institute
Chicago, IL

Suresh Verma
IIT Research Institute
10 West 35th Street
Chicago, IL 60616
Phone: (312) 567-4178 FAX: (312) 567-4329

Description:

Capable of conducting tensile, creep, creep rupture, and permeation tests on material samples in a hydrogen environment (precharged or insitu) at temperatures ranging from ambient to 2000°F and a pressures up to 3000 psi.

Potential Use(s):

Materials testing in support of the SEI nuclear propulsion project

Keywords: Hydrogen environment materials testing

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 6/06/1991
FAX: (216) 826-6613

Hydrogen Environment Materials
Testing Laboratory
Materials Engr Associates, Inc.
Lanham, MD

W. H. Cullen
Material Engr Associates, Inc.
9700B - M. L. King Jr. Highway
Lanham, MD 20706
Phone: (301) 577-9490 FAX: (301) 577-4936

Description:

Capable of conducting tensile, high cycle fatigue, crack growth, and fracture toughness tests on materials samples in a hydrogen environment ranging in temperatures from ambient to 1000°F and at pressures up to 5000 psi.

Potential Use(s):

Materials testing in support of the SEI nuclear propulsion project.

Keywords: Hydrogen environment materials testing

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 6/06/1991
FAX: (216) 826-6613

Irradiated Materials Test Laboratory
Materials Engineering Associates, Inc.
9700-B M. L. King, Jr. Hwy
Lanham, MD 20706-1837

Dr. Marshal Greenblatt
Materials Engineering Associates, Inc
9700-B M. L. King Jr. Hwy
Lanham, MD 20705-1837
Phone: (301) 577-9490 FAX: (301) 577-4936

Description:

Capable of conducting tests on neutron irradiated structural materials. Tensile, charpy impact, fatigue life, fracture toughness, and subcritical crack growth tests. Cryogenic to elevated temperatures.

Potential Use(s):

Materials testing in support of the SEI nuclear propulsion project

Keywords: Irradiated materials testing, neutron damage assessment, radiation embrittlement

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Marshal Greenblatt
Phone: (301) 577-9490

Date Prepared: 8/08/1991
FAX: (301) 577-4936

Hydrogen Environment Materials
Testing Laboratory
Southwest Research Institute
San Antonio, TX 78228-0510

Stephen J. Hudak Jr.
Southwest Research Institute
6220 Culebra Road
San Antonio, TX 78228-0510
Phone: (512) 522-2330 FAX: (512) 522-5122

Description:

Capable of conducting creep, creep rupture, and crack growth tests on material samples in a hydrogen environment (insitu) at temperatures from -300°F to 1000°F (controlled ramping / cycling) and at pressures up to 300 psi. Also capable of conducting hydrogen precharged tests at temperatures from ambient to 1000°F (isothermal) and at pressures up to 8800 psi.

Potential Use(s):

Materials testing in support of the SEI nuclear propulsion project.

Keywords: Hydrogen environment materials testing

Required Modifications/Additions:

To be defined based on specific test requirements.

Status: OPERATIONAL

Year Last Operated: 1990

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: D. H. Baldwin
Phone: (216) 826-6687

Date Prepared: 8/06/1991
FAX: (216) 826-6613

Nuclear Test Reactor
Buffalo Materials Research Center
State University of New York
Buffalo, NY 14214

Louis Henry
Buffalo Materials Research, Inc.
State University of New York
Buffalo, NY 14214
Phone: (716) 831-2826 FAX: (716) 831-2030

Description:

2 Megawatt test reactor capable of 8×10^{12} n/cm²/sec flux at $E > 1$ MeV.
Hot cells for testing of irradiated materials.

Potential Use(s):

Materials irradiation in support of the SEI nuclear propulsion project.

Keywords: Irradiation services, irradiated materials testing, radiation embrittlement

Required Modifications/Additions:

To be defined based on specific project requirements.

Status: UNDER REPAIR

Year Last Operated: 1989

Estimated Year Available: 1991

Estimated Capital Cost:

FY	92	93	94	95	96	97	98	99
\$M								

FY	00	01	02	03	04	05	06	Total
\$M								

Prepared by: Marshal Greenblatt
Phone: (301) 577-9490

Date Prepared: 8/08/1991
FAX: (301) 577-4936

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.				
1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE April 1993	3. REPORT TYPE AND DATES COVERED Technical Memorandum		
4. TITLE AND SUBTITLE Space Exploration Initiative Candidate Nuclear Propulsion Test Facilities		5. FUNDING NUMBERS WU-593-71		
6. AUTHOR(S) Darrell Baldwin and John S. Clark				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio 44135-3191		8. PERFORMING ORGANIZATION REPORT NUMBER E-7759		
9. SPONSORING/MONITORING AGENCY NAMES(S) AND ADDRESS(ES) National Aeronautics and Space Administration Washington, D.C. 20546-0001		10. SPONSORING/MONITORING AGENCY REPORT NUMBER NASA TM-105710		
11. SUPPLEMENTARY NOTES Darrell Baldwin, Sverdup Technology, Inc., Lewis Research Center Group, 2001 Aerospace Parkway, Brook Park, Ohio 44142; and John S. Clark, NASA Lewis Research Center. Responsible person, John S. Clark, (216) 891-2174.				
12a. DISTRIBUTION/AVAILABILITY STATEMENT Unclassified - Unlimited Subject Categories 16 and 20			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) This document provides one-page descriptions for approximately 200 existing government, university, and industry facilities which may be available in the future to support SEI nuclear propulsion technology development and test program requirements. To facilitate use of the information, the candidate facilities are listed both by location (Index L) and by Facility Type (Index FT). The included one-page descriptions provide a brief narrative description of facility capability, suggest potential uses for each facility, and designate a point of contact for additional information that may be needed in the future. The Nuclear Propulsion Office at NASA Lewis presently plans to maintain, expand, and update this information periodically for use by NASA, DOE, and DOD personnel involved in planning various phases of the SEI Nuclear Propulsion Project. You may send information on other facilities you would like to have added to the data base (see form page iii), or updates to the present facility descriptions, to John Clark at (216) 891-2174 (Fax Ext. 2192).				
14. SUBJECT TERMS SEI; Nuclear propulsion; NTP; NEP; Facilities			15. NUMBER OF PAGES 220	
			16. PRICE CODE A10	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT	

National Aeronautics and
Space Administration

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